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SERIES A: AGRICULTURAL.

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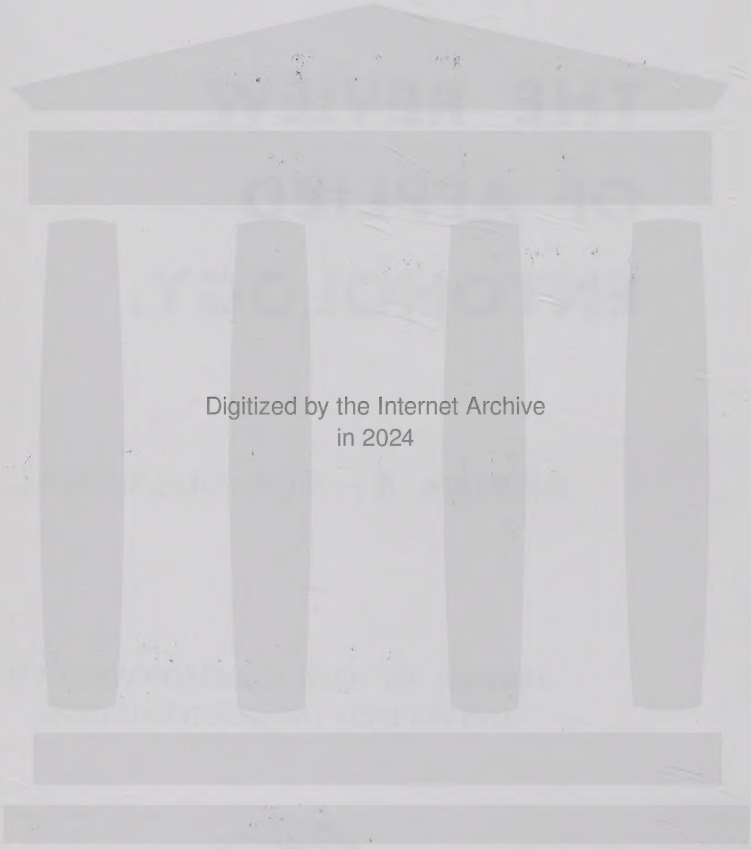

COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES A.

Vol. 41. 1953.

EDITORIAL

THE NOMENCLATURE OF CHEMICALS USED FOR PEST CONTROL

During recent years, committees have been set up in the United States and the British Commonwealth to devise and define simple "common" names for the complex organic chemicals used for the control of pests, particularly arthropods, fungi and weeds. They include the Pest Control Products Industry Standards Committee in Britain, the Canadian Committee on Common Names of Insecticidal and Fungicidal Chemicals, the U.S. Interdepartmental Committee on Pest Control, and the Committee on Insecticide Terminology of the American Association of Economic Entomologists. These committees have worked in liaison, and two lists of names approved by one or more of them have been published, one as British Standard 1831 : Part 1 : 1952, and the other in the *Journal of Economic Entomology* **45** (1952) pp. 165–166.

The names that have been recommended for insecticides are being increasingly used, without further chemical definition, by authors of papers on insect control, and it is proposed to use them in the same way in future abstracts in this *Review*, though the chemical name may also be included if the nature of the paper abstracted makes it particularly desirable. To facilitate their subsequent identification by readers, the names to be adopted are tabulated below in alphabetical order.

The recommended common name of each compound is shown in the first column of the table, the chemical name or names in the second, and other names that have been used in the third. Names marked by "a" are recommended by the Committee of the American Association of Economic Entomologists, names marked by "b" are adopted in the British Standard 1831, and names marked by "c" have been adopted by the U.S. Interdepartmental Committee. DDD, and bromo-, fluoro-, methoxy- and methyl-DDT are names adopted for DDT analogues in this *Review*, and the last four are designed to provide a consistent nomenclature for analogues of comparable structure. They are names indicative of structure in the same way as is the recommended methyl-parathion.

If additions to the list or changes in it become desirable, these will be given at the beginning of the annual volumes of the *Review*.

(42) Wt. P9/3876 2/53 S.E.R. Ltd. Gp. 432. [A]

Recommended common names	Chemical names or definitions	Other names
aldrin[a,c]	not less than 95 per cent. of 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene	compound 118
allethrin[a,c] ...	*dl*-2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one esterified with a mixture of cis and trans *dl*-chrysanthemum monocarboxylic acids	allyl homologue of cinerin I synthetic pyrethrins
BHC[a,b]	1,2,3,4,5,6-hexachlorocyclohexane benzene hexachloride (BHC is used for a mixture of isomers; the British Standard requires that the percentage of γ BHC be stated, whereas the American definition applies BHC to a mixture containing 12–14 per cent. γ BHC.)	HCH 666
α BHC, β BHC, γ BHC, etc.	individual isomers of the above	
bromo-DDT ...	a complex chemical mixture in which p,p′bromo-DDT [*q.v.*] predominates	
p,p′bromo-DDT ...	1,1,1-trichloro-2,2-di(p-bromophenyl)ethane	
chlordane[a,b,c] ...	2,3,4,5,6,7,10,10-octachloro-4,7,8,9-tetrahydro-4,7-endomethyleneindan 1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindan 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene	chlordan
DDD	a complex chemical mixture (*e.g.*, commercially available dichlorodiphenyl-dichloroethane) in which p,p′DDD [*q.v.*] predominates	TDE[a]
p,p′DDD	1,1-dichloro-2,2-di(p-chlorophenyl)ethane	
DDT[a,b]	a complex chemical mixture (*e.g.*, commercially available dichlorodiphenyl-trichloroethane) in which p,p′DDT [*q.v.*] predominates (The British Standard requires the percentage of p,p′DDT to be stated.)	dicophane, B.P. (75 per cent. p,p′DDT) chlorophenothane, U.S.P. (14 : 136. 1950)
p,p′DDT	1,1,1-trichloro-2,2-di(p-chlorophenyl)ethane	
dieldrin[a,c] ...	not less than 85 per cent. of 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethanonaphthalene	compound 497
dimethyl carbate[a] ...	dimethyl ester of cis-bicyclo(2.2.1)-5-heptene-2,3-dicarboxylic acid	
dinex[b]	2-cyclohexyl-4,6-dinitrophenol 2,4-dinitro-6-cyclohexylphenol 4,6-dinitro-o-cyclohexylphenol Salts or esters of this compound are to be differentiated by the addition in brackets of the name of the combining substance, *e.g.*, dinex (sodium).	DNOCHP
dinosam[b]	2-(1-methyl-n-butyl)-4,6-dinitrophenol 2,4-dinitro-6-sec.-amylphenol 4,6-dinitro-o-sec.-amylphenol Salts or esters to be cited as indicated under dinex.	DNAP DNSAP DNOSAP

Recommended common names	Chemical names or definitions	Other names
dinoseb[b]	2-(1-methyl-n-propyl)-4,6-dinitrophenol 2,4-dinitro-6-sec.-butylphenol 4,6-dinitro-o-sec.-butylphenol Salts or esters to be cited as indicated under dinex.	DNBP DNSBP DNOSBP
DNC[b]	2-methyl-4,6-dinitrophenol 2,4-dinitro-6-methylphenol 3,5-dinitro-o-cresol [numbered with CH_3 as 1] 4,6-dinitro-o-cresol [numbered with OH as 1] Salts or esters to be cited as indicated under dinex.	DNOC dinitrocresol
fluoro-DDT ...	a complex chemical mixture in which p,p′fluoro-DDT [*q.v.*] predominates	
p,p′fluoro-DDT ...	1,1,1-trichloro-2,2-di(p-fluorophenyl)ethane	DFDT[a]
heptachlor[a,b,c] ...	1(or 9),4,5,6,7,10,10 - heptachloro - 4,7,8,9 - tetrahydro-4,7-endomethyleneindene 1(or 3a),4,5,6,7,8,8 - heptachloro - 3a,4,7,7a - tetrahydro-4,7-endomethanoindene 1(or 3a),4,5,6,7,8,8-heptachloro - 3a,4,7,7a - tetrahydro-4,7-methanoindene 3,4,5,6,7,8,8a-heptachlorodicyclopentadiene	
lindane[a,c]	γ isomer of BHC [*q.v.*] of not less than 99 per cent. purity	
malathon[a,e] ...	O,O-dimethyl dithiophosphate of diethyl mercaptosuccinate. S-(1,2-dicarbethoxyethyl) O,O-dimethyl dithiophosphate	compound 4049
methoxy-DDT ...	a complex chemical mixture in which p,p′methoxy-DDT [*q.v.*] predominates	dianisyl trichloroethane
p,p′methoxy-DDT	1,1,1-trichloro-2,2-di(p-methoxyphenyl)ethane	methoxychlor[a,c]
methyl-DDT ...	a complex chemical mixture in which p,p′methyl-DDT [*q.v.*] predominates	ditolyl trichloroethane
p,p′methyl-DDT ...	1,1,1-trichloro-2,2-di(p-methylphenyl)ethane	
methyl-parathion[a]	O,O-dimethyl O-p-nitrophenyl thiophosphate	methyl homologue of parathion
paraoxon[a]	diethyl p-nitrophenyl phosphate	oxygen analogue of parathion E-600
parathion[a,b,c] ...	O,O-diethyl O-p-nitrophenyl thionphosphate O,O-diethyl O-p-nitrophenyl thiophosphate	E-605
piperonyl butoxide[a]	product containing as its principal constituent α-[2-(2-butoxyethoxy)-ethoxy]-4,5-methylenedioxy-2-propyltoluene	
piperonyl cyclonene[a]	mixture of 3-alkyl-6-carbethoxy-5(3,4-methylenedioxyphenyl)-2-cyclohexen-1-one and 3-alkyl-5(3,4-methylenedioxyphenyl)-2-cyclohexen-1-one.	
schradan[a,b] ...	bisdimethylaminophosphonous anhydride bis(bis(dimethylamino))phosphonous anhydride octamethyl pyrophosphoramide tetra(dimethylamido)pyrophosphate	OMPA
toxaphene[a,b,e] ...	chlorinated camphene having a chlorine content of 67–69 per cent.	compound 3956

BARNES (H. F.). **Studies of Fluctuations in Insect Populations. XII. Further Evidence of prolonged larval Life in the Wheat-blossom Midges.**—*Ann. appl. Biol.* **39** no. 3 pp. 370–373, 1 graph, 2 refs. London, 1952. **XIII. An improved Method of ascertaining the correct Date to sample when assessing larval Infestations of the Wheat-blossom Midges.**—*T.c.* pp. 374–378, 2 graphs, 2 refs.

In the first of these two parts of a series [*cf. R.A.E.*, A **33** 293], the author gives further data on the survival of larvae of *Contarinia tritici* (Kby.) and *Sitodiplosis mosellana* (Géh.), and their parasites [*cf.* **32** 225]. Larvae were collected from a field of permanent wheat at Harpenden each year between 1939 and 1951 and kept in an outdoor insectary. Larvae of *C. tritici* gave rise to adults after 1–3 winters and their parasites after one or two, and those of *S. mosellana* gave rise to adults after 1–12 winters and their parasites after 1–6. Most larvae of *S. mosellana* did not always complete their development after one winter, though they usually did so. The adult populations present in the field in any one season may therefore be derived from larvae that developed in several previous years. Since the parasites of *C. tritici* do not complete their development without overwintering [*cf.* **32** 225], the generation of this Cecidomyiid that occurs on couch grass [*Agropyrum repens*] in August-September is likely to be free from attack, and in consequence, constitutes a dangerous source of population increase.

In the second part, the author states that estimates of the populations of *C. tritici* and *S. mosellana* in the field of permanent wheat at Harpenden are normally based on samples of 50 wheat ears taken from each of ten plots about three weeks after peak emergence in each year, when the maximum number of larvae are ready to descend to the soil to pupate [*cf.* **20** 485]. Up to 1941, this date was determined from a comparison of daily emergences in the insectary with the numbers of adults seen ovipositing in the field and examination of several ears, but this method was uncertain, since showers of rain cause sudden descents of the larvae, which can only emerge from the ears under moist conditions, and lead to underestimates. In 1941, a method of pre-sampling was adopted by which samples of 50 ears were taken at frequent intervals from one plot only. In this way, several samples with high numbers of larvae are obtained, and if the larvae begin to leave the ears before the main sample of 500 ears is taken, data are available for correcting the estimated population. The data obtained for both species in 1943 and 1944 are given in tables, and the course of the descent of the larvae in 1949 and 1950 is shown on graphs. In 1949, when there was a dry spell in July, the numbers of larvae of both species in the ears remained fairly constant for about ten days and then dropped suddenly, following rain, whereas in 1950, when there was no dry spell, numbers showed a more gradual decline.

GOLIGHTLY (W. H.). **Soil sampling for Wheat-blossom Midges.**—*Ann. appl. Biol.* **39** no. 3 pp. 379–384, 1 graph, 4 refs. London, 1952.

A method of assessing populations of *Contarinia tritici* (Kby.) and *Sitodiplosis mosellana* (Géh.) by the recovery of the cocoons from soil samples, using a modification of the wet extraction technique devised for use with wireworms [*R.A.E.*, A **34** 329], is described, and an account is given of investigations in which it was used in northern England during 1947–49. The following is partly based on the author's summary. The summer of 1947 was dry, and large numbers of larvae of *S. mosellana* were still in the wheat ears at harvest. Burning the straw in the windrows immediately after harvesting considerably reduced the numbers of cocoons of both species in the soil beneath. Most larvae were within 3 ins. of the soil surface, though many were found at depths

of 3–6 ins. Infestation by both species was lighter in the headlands than in the rest of the field. Larvae of *S. mosellana* remained viable in the soil for several years [*cf.* preceding abstract], and in February 1951, as many as 150,000 per acre were recovered from a field that had not been under wheat since 1944; in the same month, 50,000 cocoons of *C. tritici* per acre were found in a field last under wheat in 1947.

It was found that viable pupae could be obtained from the soil samples, and the course of pupation of *S. mosellana* in 1948 and 1949 and of the emergence of the adults in the insectary in 1948 is shown in a graph. The interval between the appearance of the first pupa and the first adult in 1948 was about 21 days, whereas that between the peaks of pupation and emergence was only about 14 days. Pupation continued until about eight days before the appearance of the last adult, and the peak of pupation in 1948 was about a month later than in 1949. The technique may thus prove of value in forecasting outbreaks of the Cecidomyiids.

MILES (M.). **Further Observations on the Biology of the Cabbage Root Fly, *Erioischia brassicae* Bché.**—*Ann. appl. Biol.* **39** no. 3 pp. 385–391, 7 refs. London, 1952.

The following is based on the author's summary of this account of further observations on *Hylemyia* (*Erioischia*) *brassicae* (Bch.) in the laboratory and on cruciferous crops in south-eastern England [*cf. R.A.E.*, A **39** 426] carried out during 1951. Eggs were first found in the field on 2nd May, and the spring peak of egg-laying occurred in the period 19th–31st May, up to a month later than in 1948–50 [*cf.* **38** 380]. The periodic removal and examination of the surface soil round individual plants showed that eggs were continuously present from mid-June to early November. Plants under observation during this period showed an average of 285 eggs each, and other plants exposed to attack from July to November showed an average of 162. Peak periods of egg-laying by the summer generations, as indicated by numbers of eggs per plant per day, occurred in late June and early July, in mid-August and, to a less extent, in the first half of October. The plants showed no increase in the rate of infestation as the season advanced, although *H. brassicae* has a reproductive capacity of about 100 eggs per female and passes through 3–4 generations a year. The difference between the observed populations of eggs and puparia indicated that mortality in the immature stages is heavy. A Staphylinid, probably *Aleochara bilineata* Gylh., and a Cynipid, probably *Trybliographa rapae* (Westw.), were observed parasitising the puparia. One pupa of *H. brassicae* in a batch that had been collected at Aberdeen in October 1949 remained in diapause till May 1951, and a parasite identified as *T. rapae* emerged from the same batch on 3rd August 1951.

In small-scale tests, tar-oil winter wash at a concentration of 1·25 per cent. applied to cauliflower in May killed eggs of *H. brassicae* in the soil round the plants and repelled gravid females for about a week. Laboratory tests showed that BHC destroyed the larvae but had no effect on the eggs [*cf.* **38** 380].

DAVID (W. A. L.) & GARDINER (B. O. C.). **Laboratory Breeding of *Pieris brassicae* L. and *Apanteles glomeratus* L.**—*Proc. R. ent. Soc. Lond.* (A) **27** pt. 4–6 pp. 54–56, 1 fig., 4 refs. London, 1952.

The rearing technique described was developed in Britain to provide a supply of *Pieris brassicae* (L.) and its parasite, *Apanteles glomeratus* (L.), throughout the year. The *Pieris* culture was begun with field-collected eggs, which were placed on young cabbage plants in pots in cages 12 ins. square and 15 ins. high having a top and back of muslin, two sides of glass and a glass front consisting

of two sliding doors that could be lifted off. Cabbage or other leaves were given as food for the larvae. On emergence, the adults were transferred to a mating cage 40×30×36 ins. in size containing artificial flowers, each comprising a rod supporting a piece of glass tubing sealed across the middle to make a cup for honey solution and surrounded at the top by a blue paper corolla, and young cabbage plants for oviposition. The same equipment was used for rearing *Apanteles*. Young plants on which *Pieris* adults had oviposited were placed in a cage containing enough adult parasites to give a high level of parasitism, and the parasitised larvae were fed in the usual manner. Adult parasites emerged at about the same time as any unparasitised *P. brassicae*. In all cages, the length of day was extended to 16 hours by means of phosphorescent lamps, and a sunlight effect was provided in the mating cage for six hours each day by means of a tungsten filament lamp with an enamelled reflector. Rearing was carried out in a greenhouse at 20–25°C. [68–77°F.] and 50–70 per cent. relative humidity and an adequate supply of host and parasite was obtained throughout the winter and early spring of 1950–51.

FJELDDALEN (J.). **Røykemidler mot skadedyr i veksthus.** [Insecticidal Smokes against Insect Pests in Greenhouses.]—*Meld. Plantev.* no. 6, 20 pp., 4 figs., 1 ref. Oslo, 1951. (With a Summary in English.)

In this bulletin, the author explains the principles governing the use in greenhouses of insecticidal smokes released by combustion from metal containers or tablets, gives information on the contents of insecticide and the performance of various proprietary smoke generators, and records the results of tests with some of them during the winter in Norway. In almost all cases, the smokes were applied in the late afternoon or evening, and the greenhouses were kept closed overnight. Temperatures ranged from 50 to 80°F. The results showed that *Heliothrips haemorrhoidalis* (Bch.) was controlled by a single application of DDT or a mixture of parathion and methyl-parathion (from tablets), and two applications of DDT and three of the parathion mixture (the latter in a greenhouse that was not air-tight) killed all adults and larvae of *Trialeurodes vaporariorum* (Westw.). A mixture of DDT and BHC and the parathion mixture controlled Aphids after one or two applications. *Tetranychus telarius* (L.) (*althaeae* (v. Hanst.)) was controlled by two applications of azobenzene, and 94–99 per cent. of the mites (excluding the eggs) were killed by one of the parathion mixture. BHC gave satisfactory control of *Hemitarsonemus* (*Tarsonemus*) *latus* (Banks). The plants treated were very various, but the only ones injured by the smokes were young tomatos and *Pelargonium* treated with the parathion mixture against *Trialeurodes*, and a few ornamental species treated with azobenzene.

FJELDDALEN (J.). **Plommevepsen** (*Hoplocampa minuta* **Christ**). **En orientering om biologi og bekjemping.** [The Plum Sawfly, *H. minuta*. An Introduction to its Biology and Control.]—*Meld. Plantev.* no. 7, 23 pp., 7 figs., 24 refs. Oslo, 1951. (With a Summary in English.)

Hoplocampa minuta (Christ) is a serious pest of plum in southern Norway. Its distribution there is discussed and shown on a map, and an account is given of its bionomics, based largely on the literature. There is one generation a year, and the females oviposit in the calyx of the partly open or open blossoms. The larvae feed in the young fruits, migrating from one to another, and overwinter in cocoons in the soil. Experiments on control were carried out in 1939–50. In the earlier tests, the best results were given by a spray of 1–2 per cent. quassia just after petal-fall, nicotine sulphate and derris proving inferior [*cf. R.A.E.*, A **31** 78]. Tests with preparations of synthetic insecticides were

begun in 1945. Parathion (E 605) was found to be outstanding, one application at 0·01 per cent. after petal-fall proving as effective as one at 0·02 per cent. or two applications, one before flowering and one after petal-fall. It also controlled other pests, notably Aphids and *Paratetranychus pilosus* (C. & F.). DDT was satisfactory, and a paste preparation proved superior to wettable powders. A proprietary material containing 2·7 per cent. BHC, 4 per cent. azobenzene and 0·3 per cent. parathion was included in one test and gave very promising results at 0·5–1 per cent. None of the preparations caused any injury to the trees.

GROSCHKE (F.). **Zur Lebensweise des grauen Fichtenwicklers,** *Cacoecia histrionana* **Froel. (Lep., Tortric.).** [Contribution to the Bionomics of *Tortrix histrionana*.]—*Anz. Schädlingsk.* **22** pt. 5 pp. 65–67, 6 figs. Berlin, 1949.

In view of the importance of *Choristoneura* (*Cacoecia*) *fumiferana* (Clem.) as a forest pest in Canada and the desirability of controlling it biologically, investigations were begun in south-western Germany in 1947 on the closely related *Tortrix* (*Cacoecia*) *histrionana* Froel., which also attacks spruce [*cf. R.A.E.*, A **40** 196]. Adults were observed on the edges of spruce stands in the Upper Palatinate and were present from June to August. Captured individuals paired in roomy glass cages, and the females oviposited on spruce needles 1–3 days afterwards. The process of oviposition is described. Larvae hatched in 11–13 days and spun shelters at the base of the needles. They mined in the latter in the first three instars and then fed on them externally. The shelter was extended as necessary and pupation occurred in it. The pupal period lasted about a fortnight, and total development from egg to adult required six and a half months at room temperatures, which were sometimes very low. The ratio of males to females was 1·3 : 1. The larvae did not enter a winter diapause in the laboratory, so that all stages could be obtained at any season if required. When eggs laid in the laboratory in August 1948 were transferred to a young spruce tree, the larvae overwintered in the first instar, but second- and third-instar individuals were found in the field in September and January. A few larvae were observed on fir [*Abies*]. Of 75 field-collected larvae, 37 were found to be parasitised, almost exclusively by an unidentified species of *Meteorus* [*cf. loc. cit.*]. Adults of this Braconid were collected in the field, and two females enclosed with 20 first-instar larvae of *T. histrionana* probed them with their ovipositors ; 11 of the larvae died and only one parasite was reared. Further investigations are considered desirable.

SÖRGEL (P.). **Beobachtungen nach Anwendung von E 605 f und einem Hexa-Präparat bei " Italiener Zwetsche ".** [Observations following the Use of E 605 f and a BHC Preparation on " Italian Plum ".]—*Anz. Schädlingsk.* **22** pt. 5 pp. 70–71. Berlin, 1949.

In preliminary experiments in south-eastern Germany in 1948, sprays of E 605 f [an emulsion concentrate containing 70 per cent. parathion] or a proprietary BHC preparation were applied to plum primarily against *Hoplocampa flava* (L.) and *H. minuta* (Christ). All the trees received a late-dormant spray in mid-March and one or more of three later treatments with the experimental materials, the first before the blossoms opened, on 19th April, and the second and third after flowering, on 29th April and 20th May. Fruits were subsequently examined for infestation. E 605 f was markedly superior to BHC and reduced the percentage of fruits infested by *Hoplocampa* from 75·45 in the controls to 7·14 for all three treatments, 2·83 for the second and third, 5·67 for the first only and 41·95 for the third only. It is concluded that the

first application did not reduce oviposition to any great extent, that the second was highly effective, and that the third was relatively ineffective. The numbers of *Paratetranychus pilosus* (C. & F.) were greatly reduced on trees treated with E 605 f, but were scarcely affected by BHC. Infestation by *Cydia* (*Grapholitha*) *funebrana* (Treitschke), the second generation of which causes considerable loss of crop, was almost halved by E 605 f, and reduced, though to a less extent, by BHC. BHC caused some tainting of the fruits, especially following three applications.

FREY (W.). **Über die Wirksamkeit neuerer Kontaktinsektizide auf die Kohlrübenblattwespe** (*Athalia colibri* **Christ**) **und die gelbe Stachelbeerblattwespe** (*Pteronus ribesii* **Scop.**). [On the Effectiveness of modern Contact Insecticides against *Athalia rosae* and *Nematus ribesii*.]—*Anz. Schädlingsk.* **22** pt. 9 pp. 129–134, 15 refs. Berlin, 1949.

An unusually heavy outbreak of *Athalia rosae* (L.) (*colibri* (Christ)) occurred on cultivated crucifers in Schleswig-Holstein in June–July 1948, causing total loss of some crops. In laboratory tests on control, field-collected larvae, about 90 per cent. of which were in the fifth instar, were either treated with contact insecticides and confined on untreated plants or confined on plants treated with stomach poisons. The following is based on the author's summary of the results. A DDT dust was unsatisfactory, and also gave poor results when used by growers in the field. Proprietary BHC dusts were variable in toxicity, and the best of those tested gave satisfactory mortality only when applied at uneconomically high rates. A proprietary BHC emulsion spray was more effective, but the best results were given by E 605 Staub [a dust of 2 per cent. methyl-parathion] and E 605 f [an emulsion concentrate containing 70 per cent. parathion]. The former, applied in the laboratory at 9 lb. per acre, rendered all the larvae inactive in four hours and gave complete mortality in two days. It was about as effective when used in the field. E 605 f gave complete mortality in four hours at 0·02 per cent. and injured or killed 98 per cent. of the larvae after two days at 0·01 per cent. Sprays of lead or calcium arsenate gave poor control, but a calcium-arsenate dust was moderately effective against the earlier instars.

In comparative laboratory experiments with larvae of *Nematus* (*Pteronus*) *ribesii* (Scop.), BHC dusts were more effective than against *A. rosae*, while the DDT dust and the E 605 products showed about the same toxicity.

MOERICKE (V.). **Über den Farbensinn der Pfirsichblattlaus** (*Myzodes persicae* **Sulz.**). [On the Sense of Colour in the Peach Aphid (*Myzus persicae*).]—*Anz. Schädlingsk.* **22** pt. 9 p. 139, 5 refs. Berlin, 1949.

During investigations in Germany on the colonisation of plants by alates of *Myzus* (*Myzodes*) *persicae* (Sulz.), it was observed that examples placed at random on a green leaf usually attempted to feed on it. Feeding was also attempted on certain coloured surfaces other than leaves. As colour preferences can be used to increase the attractiveness of traps [*cf. R.A.E.*, A **37** 365; **39** 359], further investigations were carried out in which alates were placed on coloured paper or on paper reflecting coloured light. Attempts at feeding were readily made on yellow and green surfaces, even in subdued light, and on red ones under intense light. The Aphids left bluish-green, blue, violet or purple surfaces. White, black and various shades of grey alone caused no positive reaction, but Aphids that left a blue, violet or purple surface and alighted on a grey one attempted to feed. It is considered that the grey appeared yellow by contrast with the blue colour group, as is also the case with the human eye. A few tests with apterae gave similar results.

[Karpova (A. I.).] **Карпова (А. И.). Protection of Crops from Injuries by the Swedish Fly by treating the Soil with Hexachlorane.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 2 pp. 33–38. Moscow, 1950.

A test in the Ukraine in 1949 showed that soil treatment with BHC in spring gave little control of overwintered adults of *Cleonus punctiventris* (Germ.) emerging from the ground in a field that had previously been under beet, but considerably reduced the infestation by *Oscinella frit* (L.) of late barley subsequently sown in it. The BHC was applied at 4·5–22·5 lb. per acre in a fertiliser and worked into the soil with a cultivator on 24th April, and the barley was sown two days later. The percentages of main stems injured and of plants killed were 23–26·5 and 3·7–7·6, respectively, for BHC at 13·5–22·5 lb. per acre, as compared with 48 and 14 for the control, and the seed yield per acre was increased by 10–20 per cent. or more. Field and laboratory observations showed that the BHC treatment reduced oviposition by its fumigant effect on the adult flies, killed the newly hatched larvae by contact when the eggs were laid near the roots, and also killed larvae migrating on the plants in search of sites for entry, possibly owing to some systemic effect. Seed treatment was also effective, infestation of the main stems of barley being reduced from 38 to 6·2 per cent. by treatment with BHC at 1 : 100 by weight of seed in a 5 per cent. dust, and soil treatment with 5 per cent. BHC in the fertiliser protected autumn-sown wheat and rye even better than the spring-sown barley, possibly because of the dampness of the soil following heavy rain in August. Germination and plant growth were not impaired.

[Semenov (A. E.).] **Семенов (А. Е.). A complex Method of controlling the Cabbage Moth and the Cabbage Fly with Hexachlorane Dust.** [*In Russian.*] —*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 2 pp. 39–42, 6 refs. Moscow, 1950.

Plutella maculipennis (Curt.) and *Hylemyia brassicae* (Bch.) are the chief pests of cabbage in the Arctic regions of the Soviet Union, and observations on their bionomics and combined control were carried out in 1948 at a place on the Ob, near the Arctic circle. Adults of the overwintering generation of *Plutella* were present from late June to late July, and the larvae infested the plants from 12th to 28th July, causing great damage by feeding on the young hearts. Some of the pupae hibernated and some gave rise to adults in late August. These entered hibernation without ovipositing, but second-generation larvae are produced in autumn in some years. *Hylemyia* also has one generation in the year. The adults emerge from the overwintered puparia in the soil in late June, and the larvae were injurious from about 10th July until mid-August.

In the tests on control, a dust of 6 per cent. BHC was applied to seedlings from a perforated tin at the rate of 0·5 gm. per plant, so as to cover the whole of it and the soil round about. Three applications were made, on 1st, 10th and 20th July, and as a result, none of the plants was killed by *Hylemyia* or damaged by *Plutella*, as compared with 9·3 and 98·5 per cent., respectively, for no treatment. In a further test, a single application on 9th July, before the hearts were set, was almost as effective against *Plutella* as three on the dates mentioned.

[Kuznetzov (K. P.).] **Кузнецов (К. П.). The Effectiveness of Applications of certain Chemical Preparations in the Control of the Little Tortoise Bug.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 5 pp. 30–35. Moscow, 1950.

In laboratory experiments in the Ukraine in 1948 and 1949, dusts of 5 per cent. DDT or 7 per cent. BHC gave complete mortality in 8–10 days of overwintered adults of *Eurygaster integriceps* Put. confined on treated plants, but

hardly any mortality, as compared with no treatment, when applied to overwintering adults in autumn or spring. A few of the bugs on the treated plants oviposited, but the nymphs died shortly after hatching. In tests of sprays, complete mortality of the overwintering bugs was given by 6 per cent. DDT in diesel oil and 2 per cent. DNC in 4 days and by 1·5 per cent. BHC in diesel oil in 8 days.

In tests in wheat fields, the best results were given by DDT dusts. A 5 per cent. dust at 54 lb. per acre killed 78·6 per cent. of overwintered adults, and a 5·5 per cent. dust applied from an aeroplane killed 82·2 per cent. of a population consisting chiefly of nymphs in the first three instars, at 36 lb. per acre, and considerably reduced the numbers but gave little mortality of one consisting of young adults with some older nymphs and a few overwintered adults, at 18 lb. per acre. The BHC dust gave inferior results, apparently owing to rapid loss of effectiveness under field conditions.

ZHUKOVSKIĬ (A. V.). **Жуковский (А. В.). The Diapause of the Larvae of the Hessian Fly.** *In Russian.*—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 6 pp. 26–29, 1 graph, 8 refs. Moscow, 1950.

Variable proportions of the first-generation larvae of *Mayetiola destructor* (Say) enter diapause after the puparia are formed and do not pupate until the autumn, the adults emerging in late August or early September and ovipositing on winter cereals. Those that do not diapause complete their development rapidly and give rise to an intermediate summer generation, the progeny of which are present at the same time as those of the diapausing individuals. It has frequently been stated in the Russian literature that the diapause is associated with dry hot weather, but when the daily mean temperature is above 20°C. [68°F.], it occurs regardless of humidity, the majority of the first generation developing without diapause only in cool summers. As these are normally characterised by frequent rain, the diapause is generally omitted in wet summers. In observations over the last 25 years in the central black-soil zone of the Soviet Union, the diapause was completely omitted only in 1925, when low temperatures and frequent rain occurred in June and July. It occurred in the majority of the first generation in 1937 and in 80 per cent. of it in 1938, in which years June and July were unusually hot, and in 68 and 62 per cent. of it in 1948 and 1949, respectively, when there was an outbreak of the fly; the average temperature in June 1948 was 21·8°C. [71·24°F.], as compared with the normal 18·1°C. [64·58°F.].

In experiments in 1948, first-generation puparia collected at the end of May were kept at normal temperature and high humidity. There were two peaks of emergence, one in June, at the onset of hot weather, and the other in the first half of September, after the temperature had begun to fall again, with very few adults emerging between them. This indicated that the larvae that had pupated before the hot period completed their development without diapause, while the others diapaused until cooler weather returned, even though humidity was high. In 1949, puparia collected in early June were kept at normal temperatures (21–23°C. [69·8–73·4°F.] in June, 23–24°C. [73·4–75·2°F.] in July, 25·7°C. [78·26 F. in the first 20 days of August and 20°C. in the last ten days of August and the first of September) in contact with moist sand, at high humidity but with no contact with moisture, or without moisture, or at low temperatures (15–19°C. [59–66·2°F.]) without moisture until 12th August, after which they were transferred to the same conditions as for the second of the previous groups. In the four groups, 100, 37·8, 13·2 and 34·3 per cent. completed their development without diapause, and in the last three, 27·3, 0 and 26·4 per cent. gave rise to adults after diapause (which lasted for 90 and 100 days, respectively, in the first and last of them), the rest dying.

It is concluded that high emergence without diapause at high temperatures is possible only at very high humidities, and that without immediate and prolonged contact with water, the majority of the larvae will diapause at normal summer temperatures until these fall to 20°C. or below. At high temperatures but without moisture, the larvae gradually die off, as is sometimes observed in the field, and at low temperatures without moisture, they enter a prolonged diapause.

BELOSEL'SKAYA (Z. G.).] **Белосельская (З. Г.). DDT in the Control of the Clover Weevil.** [*In Russian.*]—*Dokl. vsesoyuz. Akad. sel.-khoz. Nauk Lenina* **15** no. 6 pp. 30–33. Moscow, 1950.

Serious losses of clover seed in the Soviet Union are caused by the larvae of *Apion* spp., which feed in the inflorescences, those of *A. apricans* Hbst. being the commonest. In experiments on the control of this weevil in the Province of Leningrad, second-year clover was dusted with 5 per cent. DDT in talc at 36 lb. per acre or sprayed with a 4 per cent. DDT suspension on 21st June 1946. The dust completely freed the plants from adult weevils in a day, whereas there was little change in the controls, reduced the average percentage of flower heads infested by larvae and the average number of larvae per flower head in July–August from 61·4 and 1·9, respectively, to 8·8 and 0·54, and nearly doubled the yield of seed per acre, while the spray reduced the adults to less than a quarter of their initial density, reduced the infestation of flower heads and the number of larvae to 23·2 and 0·95, and gave a small increase in yield. The inferiority of the spray was probably due to bad dispersion and uneven coverage of the plants. In laboratory tests on the action of DDT on the adults, the dust gave complete mortality in two days and the spray in three.

DDT dusts were further tested in 1948 and 1949, when 5 per cent. DDT in kaolin was applied at 22·5 lb. per acre. The average percentages of flower heads infested were 2·9–4·5 in 1948 and 23·24 in 1949, as compared with 11·8–12·2 and 28·38 in the controls, respectively, and the percentage increases in yield were 108–131·5 and 29·8–156·4. The DDT adhered better to the plants and persisted longer on them in talc than in kaolin, and had a stimulating effect on plant growth.

DUVAL (G.). **Fumigação experimental de sauveiros com brometo de metila.** Experimental Fumigation of the Nests of Leaf-cutting Ants with Methyl Bromide.]—*Biológico* **15** no. 1 pp. 1–9, 3 graphs, 1 ref. São Paulo, 1949.

An account is given of tests in São Paulo in 1948 in which methyl bromide was compared with carbon bisulphide as a fumigant for use against leaf-cutting ants of the genus *Atta*. Treatments were applied to 51 nests of *A. sexdens rubropilosa* Forel and nine of *A. laevigata* (F.Sm.). Carbon bisulphide was introduced into the nests through holes 28 ins. apart at the rate of 30 cc. per hole, and gave complete control of both species in every case, and methyl bromide was applied at the arbitrary rate of 100 cc. liquid per nest through 1, 3 or 5 holes, and gave complete control of both species when introduced through five holes, but not when introduced through one or three. In a discussion of the costs of treatment, it is pointed out that the nests of *A. laevigata* extend over a greater surface area than those of *A. s. rubropilosa*, and thus require a greater number of holes for treatment with carbon bisulphide. The rate at which methyl bromide was applied may have been excessive, since complete mortality was achieved in one nest that received only 50 cc.

LEPAGE (H. S.) & GIANNOTTI (O.). **Experiências de combate às pragas do algodoeiro com diferentes inseticidas orgânicos modernos.** [Experiments on the Control of Pests of Cotton with different modern organic Insecticides.]—*Biológico* **15** no. 1 pp. 10–16, 20 refs. São Paulo, 1949.

The authors review the effectiveness of synthetic contact insecticides against cotton pests and describe experiments in São Paulo in 1947–48 in which dusts of 20 per cent. toxaphene, 3 per cent. γ BHC, and 0·25 and 0·125 per cent. parathion (Rhodiatox) were applied various times, and emulsion sprays of 0·01 and 0·005 per cent. parathion five times between 26th November 1947 and 17th February 1948. All the dusts, except 0·125 per cent. parathion, and the stronger parathion sprays gave very good control of *Eutinobothrus brasiliensis* (Hambleton), as measured by the reduction in numbers of plants destroyed, and of *Aphis gossypii* Glov., with BHC much the most effective in both cases, and all treatments increased the yield, BHC doing so by 178 per cent. In subsidiary tests, dusts of 20 per cent. toxaphene, 3 per cent. γ BHC or 0·25 per cent. parathion gave complete control of *Alabama argillacea* (Hb.), and one of 5 per cent. chlordane proved satisfactory, while a parathion spray was inferior to the dust. Three applications of the parathion dust considerably increased the yield of plants heavily infested by *Horcias nobilellus* Berg.

FRANCO DO AMARAL (S.). **Biologia e importância econômica do percevejo do arroz, no Estado de S. Paulo.** [Biology and economic Importance of *Solubea poecila* (Dall.) in the State of São Paulo.]—*Biológico* **15** no. 3 pp. 47–58, 1 pl., 20 refs. São Paulo, 1949.

The author describes all stages of the Pentatomid, *Solubea poecila* (Dall.), and reviews its synonymy and geographical distribution from the literature [*cf. R.A.E.*, A **33** 147]. It causes serious damage to rice in the State of Rio Grande do Sul, Brazil, and also occurs in São Paulo. Because of its potential importance in the latter State, studies on its bionomics were carried out there in 1946–49. The bug was found to be widely distributed but not numerous. It was taken on rice, but the principal food-plant was *Echinocloa crus-pavonis* growing in rice-fields. The bugs normally feed on the rice grains in the stage of milky ripeness, but in the laboratory they also sucked the plant sap. The adults overwintered on the lower leaves or on the ground beneath the plants, and all stages were found together on *E. crus-pavonis* in November. In rearing experiments on rice in the laboratory, the results of which are shown in a table, the egg and nymphal stages lasted for averages of 11·9 and 33·4–47 days at average temperatures of 21·6°C. [70·88°F.] and 21·7–23·6°C. [71·06–74·48°F.], respectively. The adults became sexually mature about 16 days after emergence between December and April, while those emerging in May overwintered and required about 170 days. The eggs were deposited 2–21 days after pairing and females laid an average of 38·6 eggs each in batches of about 11. There are probably three generations a year.

DUARTE (G.). **Progressos no combate à broca do café com hexacloreto de benzeno.** [Progress in the Control of the Coffee Berry Borer with BHC.]—*Biológico* **15** no. 5 pp. 85–102, 2 graphs, 7 refs. São Paulo, 1949.

The author reviews work on the chemical control of *Stephanoderes hampei* (Ferr.) on coffee in São Paulo [*cf. R.A.E.*, A **39** 135, etc.] and describes experiments in 1948–49 on its control by treatment of the fallen fruits, in which it breeds between crops [*cf.* **38** 151]. Dusts of 1, 2 and 4 per cent. γ BHC were applied to the fallen fruits and ground beneath the trees at a rate of about

18 lb. per 1,000 trees, the number of applications being four at intervals of about 20 days for the weaker dusts and two at one of 40 days for the strongest, beginning in early October. These were compared with similar treatments applied to the trees themselves, beginning in mid-November, and with divided programmes, half of the number of treatments being applied to the ground, followed by the other half to the trees. The results of ground treatment alone were excellent, infestation of the new crop being very low. The divided programmes also gave very good results, but dusting the trees alone was inferior, though it gave a high degree of control as compared with no treatment. The 2 and 4 per cent. dust schedules were about equally effective and superior to the 1 per cent.

Service and Regulatory Announcements, July–December 1950.—*S.R.A., B.E.P.Q.* nos. 178–179 pp. 73–108, 109–161. [Washington, D.C.] U.S. Dep. Agric., 1951.

An announcement relating to the Fruit and Vegetable Quarantine (no. 56) contains Administrative Instructions (B.E.P.Q. 542 revised) (pp. 73–75) authorising an alternative schedule for the treatment of commercially sound fruits of orange, grapefruit and Manila mango to be imported into the United States under permit from Mexico with vapour heat against fruit-flies [*Anastrepha*] [*cf. R.A.E.*, A **33** 396 ; **34** 112], in which the temperature at the centre of the fruit is raised to 110°F. in six hours, during the first two of which the increase must be rapid, and maintained at that level for a further four hours.

An announcement (B.E.P.Q. 481 revised) (pp. 79–80) relating to the Hawaiian Fruit and Vegetable Quarantine (no. 13) modifies the vapour-heat treatment effective against eggs or larvae of the oriental fruit-fly [*Dacus ferrugineus dorsalis* Hend.], the Mediterranean fruit-fly [*Ceratitis capitata* (Wied.)] and the melon fly [*D. cucurbitae* Coq.] and authorised for application in Hawaii to papayas, bell-peppers [*Capsicum*], Italian squash and tomatos that are to be moved interstate, by substituting for the eight-hour period during which the temperature at the centre of the fruit is raised to 110°F. [**39** 156] a period of which the duration is to be designated by the supervising inspector, and by requiring the treating plant to be fitted with an acceptable self-recording temperature and humidity indicator. In a further revision (B.E.P.Q. 481 revised) (p. 113), this modified treatment is authorised for pineapple.

An announcement relating to quarantine no. 52 against the pink bollworm [*Platyedra gossypiella* (Saund.)] (B.E.P.Q. 558, revised) (pp. 80–84) extends that part of the lightly infested area in the United States from which cottonseed that has been subjected to treatment may be moved under permit to any destination to include two additional counties in New Mexico, and authorises the bulk fumigation with methyl bromide in road or railway vans [**39** 223] as an alternative second treatment [**36** 105 ; **37** 376] for cottonseed produced in the heavily infested area prior to its movement interstate.

Other information in these parts includes revised summaries of plant quarantine restrictions in Egypt (pp. 99–105), France (pp. 137–143) and French Morocco (pp. 143–151), supplements to summaries of restrictions already noticed in Bermuda (p. 134) [**38** 53, etc.], Canada (pp. 135–136) [**39** 157], Costa Rica (pp. 136–137) [**26** 134] and Holland (pp. 151–152) [**38** 53], summaries of the current domestic and foreign plant quarantines of the United States and its Territories and of other restrictive orders under the Plant Quarantine Act [**17** 163] (pp. 154–160), and the results of a survey during June–July 1950 of fruit-flies and other insect pests and diseases of *Citrus* present in Cuba, during which over 3,600 *Citrus* trees and over 1,100 other trees suspected of harbouring fruit-flies were examined (pp. 75–79).

GHESQUIÈRE (J.) & CARAYON (J.). **A propos de quelques *Antestia* et *Helopeltis* de l'Afrique tropicale (Hemiptera Pentatomidae et Miridae).**—*Rev. Zool. Bot. afr.* **41** fasc. 1 pp. 55–65, 2 figs., refs. Tervuren, 1948.

CARAYON (J.) & DELATTRE (R.). **Les *Helopeltis* (Hem. Heteroptera) nuisibles de Côte d'Ivoire.**—*Rev. Path. vég.* **27** fasc. 4 pp. 185–194, 4 figs., 21 refs. Paris, 1948.

These two papers are based on a comparison of material collected in French West Africa by Carayon with specimens in the Congo Museum at Tervuren and other collections.

In the first of them, the authors state that the African speckled bugs of the complex of *Antestia faceta* (Germ.) (*variegata* (Thnb.)) fall into six more or less well-defined biogeographical groups, though they are difficult to identify, even from their genitalia, and discuss the identity of certain forms that occur on coffee. They consider that *A. bechuana* (Kirky.) is a valid species ; it has been misidentified as *A. variegata* and *A. lineaticollis* (Stål) *cf. R.A.E.*, A **36** 367 and referred to as *Antestia* prox. *lineaticollis* **36** 295]. It occurs on coffee in Nyasaland, Uganda, and the Belgian Congo, where it is widely distributed to the south-west of Lake Kivu and ranges northwards to Ituri.

The true *A. lineaticollis* occurs in Tanganyika, but the bug recorded as *A. lineaticollis* on coffee in Tanganyika by Kirkpatrick [**25** 95 ; **26** 178] is an undescribed species. At least three forms close to *A. transvaalia* Dist. occur on coffee in the Katanga region of the Belgian Congo ; they may represent distinct species or merely ecological varieties of *A. transvaalia*. Forms related to the western group of the complex occur on coffee to the north of Kivu ; one from the region of Rutshuru is described from adults of both sexes as *A. intricata*, sp.n., and it is stated that two examples of it were taken on coffee to the south of Lake Kivu in 1939.

The genus *Helopeltis* is also widely distributed in tropical Africa. In the Belgian Congo, there are three main polyphagous species, *H. bergrothi* Reut., *H. schoutedeni* Reut. and *H. westwoodii* (White), with which are associated a series of species or varieties of potential importance, including *H. orophila* Ghesq., which has become adapted to *Cinchona* [*cf.* **34** 153, etc.]. Characters are given differentiating *H. bergrothi* and *H. schoutedeni*, which was formerly confused with it. Each has several varieties or ecological forms. The varieties of *H. bergrothi* include *disciger* Popp. [**34** 63], *rubrinervis* Popp. [**34** 63], *flavescens* Ghesq., *mayumbensis* Ghesq., which is injurious to cacao in the Belgian Congo and the Ivory Coast, and *nigripes* Ghesq., and those of *H. schoutedeni* include *vanderysti* Ghesq., *bergevini* Popp., which is confined to its country of origin [the Chari region of French Equatorial Africa] and of which records in the Belgian Congo refer to forms of *H. bergrothi*, and probably *plebejus* Popp., only cotypes of which were seen. *H. bergrothi* and its varieties prefer the forest zone with continuous rain, while *H. schoutedeni* and its varieties are more widespread, extending north and south of the equator to the regions with a well-marked dry season. Both these species show seasonal variations in the length of the antennal segments, and there is also considerable variation in colour [*cf.* **33** 383]. Descriptions by Ghesquière are appended of *H. rauwolfiae*, sp. n., from Ubangi, Belgian Congo, and a new variety of it named *fulva* from Niger, in French West Africa. *H. rauwolfiae* attacks *Rauwolfia* sp., and the nymphs died when confined on cotton. Certain forms with green nymphs found on cacao in the Gold Coast and Nigeria may represent varieties of it.

In the second paper, the authors refer to the difficulty of identifying the species of *Helopeltis*, although the genus itself is well defined, and state that at least four species are injurious in the Ivory Coast. These are *H. schoutedeni*, *H. bergrothi*, a species referred to as *H.* prox. *rubrinervis* and *H. westwoodii*. A key to them is given. *H. schoutedeni* is the common species on cotton, on

which it has frequently been misidentified as *H. bergrothi* [**14** 223 ; **25** 193 ; **38** 140]. *H. sanguineus* Popp. [**33** 383], which was considered in the first paper to be a variety of *H. schoutedeni*, is stated not to differ even varietally from it [*cf.* **38** 140]. *H. schoutedeni* also attacks *Cinchona* in the Ivory Coast, but has not been found on cacao, at least in French Africa. *H. bergrothi* is the common species on cacao in the Ivory Coast, the Gaboon, and the Belgian Congo, and is probably also common in the Gold Coast, though the identity of the species on cacao there is uncertain. It does not apparently attack cotton in the Ivory Coast, but may be the species recorded from cotton in British Togoland as *H. labaumei* Popp. [**29** 516], a species that is, so far as known, restricted to Spanish Guinea, the Gaboon and the Belgian Congo and does not attack cultivated plants.

The name *H.* prox. *rubrinervis* is used for a common species of uncertain identity that attacks mainly cacao. It is the commonest *Helopeltis* on that crop in the Gold Coast and the Spanish territories on the Gulf of Guinea, and also infests it in the Cameroons and the Ivory Coast. It has been taken on cotton in Nigeria and also in the Ivory Coast, but its occurrence on that plant may have been accidental, since individuals caged on cotton died without feeding. *H. westwoodii* is polyphagous and of little importance as a crop pest. It damaged banana fruits in the Ivory Coast in 1936 and occurs on *Cinchona* in the Ziama range and on cacao in the Cameroons and the Gaboon [*cf.* also **39** 373].

In a supplementary note by Carayon, it is stated that examination of *Helopeltis* material in the British Museum has shown that all the specimens collected on cotton in the Gold Coast, British Togoland and the Anglo-Egyptian Sudan are *H. schoutedeni*, though some from Togoland may represent a light variety of it, so that *H. schoutedeni* appears to be at present practically the only species on cotton in West Africa. The *Helopeltis* close to *H. bergrothi* collected on cacao in the Gold Coast possibly represent var. *mayumbensis*, which also occurs on cacao in the Ivory Coast, though it is less common there than the typical form.

Schmitz (G.). **La pyrale du caféier robusta** *Dichocrocis crocodora* **Meyrick. Biologie et moyens de lutte.**—*Publ. Inst. nat. agron. Congo belge*, Sér. sci. no. 41, 132 pp., 36 figs., 183 refs. [Brussels] 1949.

This account of investigations on the bionomics and control of *Dichocrocis crocodora* (Meyr.) on coffee in the Belgian Congo contains much information that has already been noticed from a shorter report [*cf. R.A.E.*, A **40** 268] and the results of additional observations in 1948. All stages of the Pyralid are described.

In the laboratory, the number of eggs laid per female was 39–272 in 1946 and 48–80 in 1948, and egg masses averaged 48 eggs and hatched in an average of 11 days. The larvae are here stated to pass through five instars, lasting 2–5, 2–6, 4–7, 6–12 and 12–20 days, respectively, and to disperse from their colonies about 12–15 days after hatching and soon after the third moult. The pupal stage lasted only 21–30 days except under conditions of low humidity, when it was much longer [*cf.* **40** 269]. Adult life averaged 2–3 days for males and unfertilised females and six days for fertilised females, and the sexes occurred in about equal numbers.

Methods of control, including destruction of adults, destruction of colonies of young larvae, which should begin with the first generation of the year, the application of insecticides against the older larvae and the cutting of hedges and clearing of the soil to destroy pupae are described [*cf.* **40** 269]. Detailed laboratory and field tests with sprays of lead and calcium arsenates, paris

green, DDT, BHC, pyrethrum, derris and barium fluosilicate and dusts of some of these showed that all were toxic to larvae. Lead arsenate was the cheapest and most effective, but was less stable in suspension than DDT or BHC. These, however, did not persist for so long and may affect the biological balance adversely, and it is concluded that insecticides should be applied only to outbreak centres and only if cultural methods have proved inadequate.

Of the parasites found attacking *D. crocodora*, *Trichogramma luteum* (Gir.) destroyed some 25 per cent. of the eggs and also gave some indirect control, since, when the number of eggs in the mass and therefore of larvae in the colony is reduced, the latter may not be able to protect themselves adequately from bad weather or predators. Up to nine parasites emerged per host egg, and the ratio of males to females was 1 : 2·7. The immature stages lasted 8–13 days, and the adults lived for 24–36 hours without food and for several days with it. Females oviposited on the day of emergence and laid 38–113 eggs in 4–5 days.

The larvae of *D. crocodora* were parasitised by *Microgaster vacillatrix* Wlkn. and *Apanteles congoensis* Saeger [*cf.* **40** 269]. The first is a solitary parasite of the young larvae, the eggs being deposited on those in the first or second instar. The mature parasite larva leaves the fourth-instar host before spinning its cocoon, and the adult emerges 4–7 days later. The percentage parasitism did not exceed 15. *A. congoensis* is a gregarious parasite of the older larvae, the eggs being laid in hosts in the fourth or fifth instar. The egg and larval stages last 15–30 days, and the mature larvae leave the host during its fifth instar, make cocoons in irregular masses of 5–30 and give rise to adults 4–9 days later. An average of 24 parasites per host was observed in the laboratory. The introduction of this Braconid into an infested plantation in the cocoon stage or by collecting larvae of *D. crocodora* from a heavily parasitised plantation, transporting them rapidly to the new one and exposing them in the branches in small baskets containing about 15 each and some living foliage, gave promising results in 1946.

Three secondary parasites, *Eurytoma syleptae* Ferrière, *Pleurotropis nigripes* Wtstn., and *Syntomosphyrum phacosoma* Wtstn., were observed attacking *A. congoensis*, but did not provide an effective check. *Eurytoma* was reared from 30 per cent. of the cocoons in 7 per cent. of the cocoon masses examined in 1946, and from nearly the same proportion in 1948. Eggs were laid externally on the pupae and hatched in 2–4 days ; not more than one larva developed in a single host, though 1–3 eggs were deposited, and the larval and pupal stages lasted 7–9 and 6–7 days, respectively. *Pleurotropis* was a solitary endoparasite. The ratio of males to females was 3 : 7, and they lived one and three days, respectively, without food and 40 with it. The egg, larval and pupal stages lasted 3, 5–7 and 8–11 days. *Syntomosphyrum* was a semi-gregarious ectoparasite. There were nearly twice as many females as males, and the adults lived for up to 44 days when food was provided. The females deposited 1–6 eggs within each host cocoon, those that had developed semi-gregariously (2–4 per host) laying totals of 9–30, and a large one that had developed singly 61. The eggs were deposited during the first 6–8 days after emergence on pupae not more than 2–3 days old, and the egg, larval and pupal stages lasted 2–3, 6–7, and 7–9 days. On two occasions, an *Apanteles* pupa was observed bearing an egg of *Eurytoma* and one of *Syntomosphyrum* ; only the *Eurytoma* larvae developed. *Ceraphron* (*Calliceras*) *vandenbrandei* Benoit was obtained in small numbers from cocoon masses of *A. congoensis* parasitised by *Syntomosphyrum* and may be a tertiary parasite.

The Ichneumonid, *Echthromorpha varicgata* (Brullé), emerged from pupae of *D. crocodora*, but its biology is unknown and the percentage parasitism in 1946 was only 0·5–0·6. Descriptions are included of the adults of all the parasites and hyperparasites discussed.

BOYES (W. W.), JEFFERY (C. W.) & GINSBURG (L.). **Effect of Dinitro-cresol Spray on the Storage Quality of Pears.**—*Fmg in S. Afr.* **25** no. 290 pp. 173–176. Pretoria, 1950.

The following is based on the authors' summary. Storage tests were conducted in South Africa in 1948–49 on pear fruits of the varieties Williams' Bon Chrétien, Beurre Hardy and Winter Nelis from trees that had received a dormant spray of oil emulsion or oil emulsion containing 2·8 per cent. DNC. Fruits of the variety Bon Chrétien from trees that received oil only ripened normally after removal from cold storage to a ripening temperature of 50°F., whereas those from trees sprayed with DNC failed to ripen normally and became blotched in appearance, with green or yellow patches. The pressure required for penetration of these pears by a $\frac{5}{16}$in. plunger (the criterion of ripening) never fell below 10 lb. at the ripening temperature. The flesh, especially that below the green areas, remained hard and gritty, and that round the pips became woody ; few of the fruits ripened sufficiently for eating. Pears that were kept at air temperature and were not put into cold storage ripened normally and showed no apparent differences due to treatment.

In all three varieties, the pressure required before storage for penetration of fruits from trees sprayed with DNC was rather greater than that for fruits from oil-sprayed trees. The DNC spray did not appear to have any significant effect on the ripening of Beurre Hardy and Winter Nelis pears on removal from storage, but there were indications that Beurre Hardy pears from trees sprayed with DNC were slightly more susceptible to core-breakdown than those from trees sprayed with oil ; their storage life was 12 weeks at 34°F. and 16 weeks at 31°F. The ripening of Winter Nelis pears from trees sprayed with DNC was slightly retarded. After storage for 16 weeks at 31°F., all the fruits were still sound and ripened satisfactorily.

SEGROVE (F.). **Oviposition Behaviour in the two Strains of the Rice Weevil, *Calandra oryzae* Linn. (Coleopt., Curculionidae).**—*J. exp. Biol.* **28** no. 3 pp. 281–297, 6 graphs, 16 refs. London, 1951.

The following is based partly on the author's summary. The oviposition behaviour of the large strain of *Calandra oryzae* (L.) [*R.A.E.*, A **33** 361] in English wheat was investigated at 20 and 25°C. [68 and 77°F.] and under moisture conditions equivalent to 50 and 70 per cent. relative humidity. Some comparative experiments were also made with the small strain at 25°C. and 70 per cent. humidity. In experiments with the large strain, females kept at 70 per cent. humidity oviposited over periods of 24 weeks at 25°C. and 32 at 20°C., whereas the corresponding figures for females kept at 50 per cent. humidity were 12 and 14. The mean numbers of eggs laid per female at 50 and 70 per cent. humidity were 44·6 and 235, respectively, at 20°C. and 37·1 and 217 at 25°C. Under all conditions, the oviposition rate quickly rose to a peak and subsequently showed a gradual decline. When weevils were isolated in pairs at 20°C. and 70 per cent. humidity and 5, 10, 20 or 40 wheat grains were provided per fortnight, the mean total numbers of eggs deposited per female were 141·2, 156·3, 235 and 269, respectively ; it is unlikely that conditions for maximum fecundity were reached in this experiment. Females that were isolated from males soon after the experiment began showed a higher initial rate of oviposition than those permanently accompanied by males ; this was followed by a more rapid decline, however, and there was little overall increase in egg production. At 25°C. and 70 per cent. humidity, the fecundity of the large strain was some 50 per cent. higher than that of the small one. The distribution of eggs between grains differed in the two strains, the small one distributing its eggs more at random and the large one tending to crowd its eggs into fewer grains. The evidence suggests that this is due to the greater

preference of females of the large strain for large grains. From a comparison of the results with those from other sources [**24** 689; **37** 324], it is nevertheless concluded that both strains tend to avoid ovipositing in grains already containing eggs or larvae, and that where many such eggs are present, oviposition is likely to be inhibited.

KROGH (A.) & WEIS-FOGH (T.). **The respiratory Exchange of the Desert Locust** (*Schistocerca gregaria*) **before, during and after Flight.**—*J. exp. Biol.* **28** no. 3 pp. 344–357, 4 figs., 23 refs. London, 1951.

The following is virtually the authors' summary. The respiratory exchange of mature males of *Schistocerca gregaria* (Forsk.) was studied during tethered flight in a small container and compared with the exchange before and after flights of varying duration. All determinations were based on gas analyses, and so the carbon dioxide output and the oxygen uptake were determined simultaneously. The accuracy of the analytical procedure is discussed and the determination of the R.Q. (respiratory quotient) before and during flight found to be valid. The figures of the oxygen consumption are reduced to normal temperature and pressure.

During rest at 27–30° C. [80·6–86° F.], the oxygen consumption amounted to 0·63 l. oxygen per kg. per hour, which means that an average male of 1·8 gm. consumed 18 cu. mm. oxygen per minute. During flight, however, the consumption was 15–50 times as great, the corresponding figures being 10–30 l. oxygen per kg. per hour or 300–900 cu. mm. oxygen per minute in an average male. After even a short period (10 minutes) of flight in a roundabout or in front of a wind tunnel, a distinct "oxygen debt" (total increase in oxygen uptake during flight) was demonstrated. After prolonged flight (90–195 minutes) the debt was nearly doubled. It corresponded to 0·3–0·7 l. oxygen per kg. or to the oxygen consumption during only 0·5–1·5 minutes of flight, so that anaerobic processes could not amount to much. It was characteristic that the recovery lasted at least one hour. The R.Q. in resting animals averaged 0·82, and during the first 30 minutes of flight the same value was obtained, but during the following 60 minutes a statistically significant decrease of the R.Q. could be demonstrated, the average value in this period being 0·75. This unexpected result strongly indicates that, unlike the other insects investigated so far, locusts utilise mainly fat as a source of energy during sustained flight. It is suggested that a surplus of ketone bodies caused by the intensive breakdown of fats might explain the prolonged recovery of 1–2 hours duration in *Schistocerca*, the recovery after flight in *Drosophila*, which flies on carbohydrate, lasting only two minutes or less in spite of the same relative rate of combustion.

PARRY (D. A.). **Factors determining the Temperature of terrestrial Arthropods in Sunlight.**—*J. exp. Biol.* **28** no. 4 pp. 445–462, 8 figs., 20 refs. London, 1951.

The following is the author's summary of the investigations described, which have direct application to arthropods, notably locusts. A study has been made of the factors determining the temperature of terrestrial arthropods in sunlight. For such animals the most important forms of heat exchange, which determine the equilibrium temperature, are radiation and convection. Compared with these, evaporation and metabolism are insignificant except under unusual circumstances. Convection depends on the size of the body in such a way that the temperature of similar animals in similar circumstances will vary as about the square root of the linear dimensions. Other morphological features affecting temperature are shape, orientation and colour. The factors on which such animal temperatures depend are difficult

to measure, and it is unlikely that temperatures will ever be accurately deduced from heat-balance considerations. But the insignificance of metabolism and evaporation implies that the temperature of the living animal in a given situation is likely to be very similar to that of an inanimate body of the same approximate size, shape, colour and orientation. If the temperature of such a body can be measured it forms a type of thermometer giving information of direct biological significance. Terrestrial arthropods may be as warm as, or warmer than, the " warm-blooded " animals, particularly on the ground where conditions change rapidly over small distances so that animal temperatures must be profoundly affected by behaviour. Laboratory data on evaporation at high temperatures do not apply directly to conditions in the field, because an animal warmed by the sun will not necessarily lose water at the same rate as one warmed to the same temperature by warm air at the same relative humidity.

EICHLER (W.). **Behandlungstechnik parasitärer Insekten.** [Methods of treating parasitic Insects.]—9×6 ins., xiv [+1]+ 286 pp., 82 figs., 226 refs. Leipzig, Geest & Portig, 1952. Price *DM.* 19.60.

This book is primarily concerned with arthropods that attack man or animals, but Aphids and a few other pests of plants and some insects that are parasitic on others are included in its scope. The methods discussed are those mentioned in literature that is not readily accessible or that have a wide general application. The work contains sections on collecting hosts or parasites, laboratory rearing, and the use of insects for tests of the presence or effectiveness of insecticides. A further section dealing mainly with artificial infection with disease organisms contains notes on the diseases of Lepidopterous larvae and ways of assessing the infestation of plants by various insects. Methods of mounting specimens and preparing slides are described in the final section, which also contains suggestions for arranging and cataloguing collections and descriptions of techniques for examining and identifying specimens.

An appendix contains discussions of formulae for expressing the influence of temperature on insect development and of the effects of climate on fluctuations in numbers of insects that attack plants, definitions of numerous German technical terms describing host-parasite relations, and a list of vegetables and some other plants showing the aphids that infest them in central Germany and some other areas.

STARR (D. F.), SCHULZ (J. T.) & FERGUSON (P.). **Results of Field Tests on Use of Ryania Insecticides in Corn Borer Control.**—*Agric. Chem.* **7** no. 5 pp. 69, 71, 73, 75, 117, 2 graphs, 4 refs. ; no. 6 pp. 46–47, 135. Baltimore, Md., 1952.

In view of the synergistic action of n-propyl isome (di-n-propyl-maleate-isosafrole condensate) in combination with ryania against the European corn borer [*Pyrausta nubilalis* (Hb.)] already reported [*R.A.E.*, A **38** 496], investigations on the control of the first generation of *P. nubilalis* on sweet maize with ryania, alone or with synergists, and other insecticides were carried out in Minnesota in 1950–51. Low-volume sprays were applied with a high-clearance sprayer at 35 U.S. gals. per acre (except in one instance, when 50 U.S. gals. was used) and dusts by aeroplane or ground machine. The sprays were applied with little clogging, by means of nozzles giving a flat spray. Three of these per row were used on a sprayer equipped with a boom to spray eight rows at a time, and this was operated at a speed of 2·7 miles per hour with a pressure of 40 lb. per sq. in. in the spray pump. No wetting agent was needed, but 0·3 lb. of a neutral alkylarylsulphonate per 6 lb. ryania was added in the spray tank, in 1950. In that year, three applications were made at intervals

of eight days, beginning when there were 100–250 egg-masses per 100 plants, a week after the onset of moth flight, and in 1951 two applications were made, 5–6 days apart, beginning when nearly all the eggs had hatched and there were 200–300 larvae per 100 plants, three weeks after the beginning of moth flight. Moth flight began when there was an accumulation of 610–637 mean degree-days over 50°F.

Spray concentrations were adjusted to give 3–6 lb. per acre of ryania alone, 1·5–6 lb. of a mixture of ryania and n-propyl isome (30 : 1), 1·5–3 lb. of mixtures of the same materials at 15 : 1 and 10 : 1, 3 lb. of mixtures of ryania and sulphoxide (isosafrole n-octyl sulphoxide) (30 : 1 and 10 : 1), 6 lb. 25 per cent. DDT emulsion concentrate or 3 lb. 15 per cent. parathion wettable powder. Dusts containing 7·5 per cent. ryania, alone or with 0·5 per cent. n-propyl isome, 40 per cent. ryania, or 2 per cent. parathion, were applied at 35 lb. per acre and 15 per cent. ryania with 0·5 per cent. n-propyl isome and 5 per cent. DDT both at 40 lb. by aeroplane ; and dusts containing 40 per cent. ryania or 2 per cent. parathion at about 25 lb. per acre, 15 or 7·5 per cent. ryania with 0·5 per cent. sulphoxide at 25 and 30 lb., respectively, 15 or 7·5 per cent. ryania with 0·5 per cent. n-propyl isome at 30 and 35 lb. and 5 per cent. DDT and 2 per cent. EPN (O-ethyl O-p-nitrophenyl benzenethiophosphonate) at 35 and 30 lb. by ground machine.

The results showed that a 30 : 1 combination of ryania and n-propyl isome was probably the most practical for both spray and dust, higher proportions of n-propyl isome or the substitution of sulphoxide for it adding to the cost without improving toxicity (with one exception). Ryania formulations caused outstanding increases in yield, and parathion good ones, but DDT was erratic and EPN gave smaller increases than 40 per cent. ryania, possibly owing to plant injury since control was as good. A spray of ryania and n-propyl isome (30 : 1), applied at 6 lb. actual insecticide per acre, gave significantly greater yield that any other treatment but parathion, from which the difference was almost significant, and twice as great an increase as the same spray at 3 lb. insecticide per acre. When quantity of insecticide was plotted against yield, the graph showed that every pound of ryania per acre in dust or spray increased the yield by 0·096 ton per acre, whereas every pound applied with 0·03 lb. n-propyl isome increased it by 0·183 ton, indicating that 1 lb. n-propyl isome in such a combination is equal to 27 lb. ryania. These results probably show the yields obtainable with complete lack of plant injury and good control of *P. nubilalis*, but there is a remote possibility of plant stimulation or the control of some other pest. The late applications in 1951 gave very good results, although earlier ones would have been better.

Ryania gave greater reductions in side infestation than in tip infestation, but the latter is easier to trim off. Ground applications of dust were more effective than applications by aeroplane, in which the dust containing 15 per cent. ryania and 0·5 per cent. n-propyl isome was equal to any other, or possibly better ; the 40 per cent. ryania dust was probably less suitable for aeroplane treatment because its lightness reduced the amount that could be carried and increased the difficulty of accurate application. The use of ryania did not cause undesirable residues on either the foliage or the edible parts of the plant. Parathion dissipates rapidly and does not leave undesirable residues but is dangerous to apply, and DDT and EPN may leave undesirable residues on the silage.

CASIDA (J. E.) & ALLEN (T. C.). **Absorption and Translocation of Insecticides by Plants.**—*Agric. Chem.* **7** no. 6 pp. 41–43, 135, 137, 4 refs. Baltimore, Md., 1952.

The authors give a short description of the ways in which chemicals are absorbed by plants and discuss the penetration of specific materials. Fumigants

enter directly through the stomata, particularly when sunlight and high temperatures accentuate stomatal opening, and may injure the plants or affect the flavour of foodstuffs. Mineral oils readily enter leaf stomata or penetrate the plant epidermis and carry dissolved insecticides into the plant ; pure oils penetrate more readily than emulsions, and salts of oleic or stearic acid may retard penetration. Absorbed oils do not constitute a serious health hazard, though impurities or insecticides dissolved in the oil may be phytotoxic, since they are carried to sites of high metabolic activity. Also, the penetration of the oil may be so great that surface residues of the dissolved insecticide are inadequate for control. Soluble arsenic penetrates the epidermis of leaves so readily that insoluble compounds must be used or penetration reduced by the addition of ferric oxide or mixtures of zinc sulphate and lime. Lead arsenate is taken up from the soil only in very small quantities, which have never resulted in dangerous residues in edible portions of the plants. The principal danger is of plant injury. Fluorine is similar to arsenic in penetration. Selenium compounds are readily absorbed, and sodium selenate absorbed by the roots of many plants serves as an effective systemic insecticide. It causes little plant injury, but its high mammalian toxicity makes it unsafe to use on plants to be used for food. Derris constituents are translocated from dusted foliage to other leaves in sufficient amounts to be somewhat insecticidal, and sodium fluoroacetate, which occurs naturally in *Dichapetalum cymosum*, is readily absorbed by roots or leaves and translocated up or down in insecticidal quantities. Its phytotoxicity is low, but its high mammalian toxicity limits its practical use.

Among synthetic organic compounds, DNC may penetrate the leaf epidermis directly (more rapidly as the acid than as a salt) or may diffuse as a gas through the stomata, but is phytotoxic, and bis(2-fluoroethoxy)methane, bis(2-fluoroethyl)ether and bis (2-(2-fluoroethoxy)ethoxy)methane are readily absorbed from the soil and translocated in insecticidal amounts without harm to the plant, but have a high mammalian toxicity. DDT is not normally translocated into edible parts of plants in sufficient quantities to endanger health, and the nature and toxicity of metabolic products of it are not known, but there is evidence that the causative agent for the stimulation of plants by DDT [*cf. R.A.E.*, A **37** 468] must be absorbed and translocated and that certain phytotoxic impurities penetrate more rapidly than DDT itself. DDT is rapidly carried into *Citrus* fruits and foliage by kerosene, but slowly returns to the surface, and the absorption of DDT in oil directly through the cuticle of certain tropical foliage may be so great as to leave little surface residue, and the absorbed material may be translocated up and down in small amounts into the stem and roots. BHC is apparently absorbed and translocated in sufficient amounts to be a hazard, causing tainting of edible portions after applications to soil or foliage, and may be incorporated into the cell sap. The differences between its isomers in toxicity to plants and insects and effects on flavour make a careful study of their penetration desirable. The phytotoxic effects of toxaphene and chlordane suggest that there is some penetration of these or their impurities and chlordane may affect the flavour of plants in treated soil. Aldrin has not been detected in edible parts of plants grown in treated soil. Preliminary evidence indicates a possible degradation of dieldrin within *Citrus* fruits and leaves after penetration into the tissues. Because of the instability of organic phosphates, absorption is mostly significant for its effect on the plants.

Tetraethyl pyrophosphate, as the purified chemical or in hexaethyl tetraphosphate, is rapidly absorbed, as indicated by metabolic disturbances. Parathion and paraoxon may be translocated up or down in plants in insecticidal amounts, and absorbed parathion or its impurities may be very phytotoxic. Chemical alteration of absorbed parathion has been observed in *Citrus* fruits. The principal systemic insecticides containing phosphorus are schradan

(octamethyl pyrophosphoramide), Systox (O-(2-(ethylmercapto)ethyl) O,O-diethyl thiophosphate), triphosphoric acid penta(dimethylamide) and the bis(dimethylamino) and bis(monoisopropylamino) fluorophosphine oxides. A high degree of solubility in water is desirable but not essential for systemic insecticides. Schradan is translocated throughout the actively growing plant after exposure of roots, seed or cut stem, and repeated applications to the upper leaf surface may result in transference from leaf to leaf. Its concentration in nutrient solutions is increased by plants growing in them, since the roots absorb water more rapidly than schradan. Absorption by the roots may be inhibited by very small amounts of nutrient phosphorus, and plants and animals produce a more effective cholinesterase inhibitor than schradan itself by their metabolism of it. There is no evidence of such action in the case of Systox. Commercial use of the systemic phosphates is restricted, since little is known of the toxicity to mammals of the compounds formed from them by metabolic breakdown within the plants.

KITSELMAN (C. H.), DAHM (P. A.) & BORGMANN (A. R.). **Toxicologic Studies of Aldrin (Compound 118) on large Animals.**—*Amer. J. vet. Res.* **11** no. 41 pp. 378–381, 1 ref. Chicago, Ill., 1950.

In experiments to determine the acute, subacute and chronic toxicity of aldrin to cattle and sheep, the test animals were allowed to feed on lucerne that had been sprayed in the field with 0·5 lb. aldrin per acre eight days before cutting, and had then been dried, baled and stored, or on their normal rations with the addition of known amounts of the compound dissolved in maize oil, or were given a drench of the solution. Bioassay of the treated lucerne with house-flies *Musca domestica* L.] [*cf. R.A.E.*, A **38** 373] showed not more than 8 parts aldrin per million at any time during the experiments. Neither sheep nor cattle that fed on the sprayed lucerne showed any toxic symptoms during feeding periods of 169 and 213 days, respectively, and less than 4 p.p.m. aldrin was found in the liver and only 2 p.p.m. in the body fat of one of the ewes and less than 1 p.p.m. in the liver, kidney, brain and body fat of a heifer immediately afterwards. Fat samples obtained by biopsy from beef cattle that fed on the treated hay for 213 days and then pastured on grass free from aldrin for three months contained less than 1 p.p.m. aldrin, and milk from a cow that fed on treated hay for 91 days showed no trace of the chemical throughout that period. One ewe, one steer, one heifer and one cow that were given 6, 7·5, 4 and 2 mg. aldrin per kg. body weight per day, respectively, in their rations or as a drench died after consuming about 8, 19, 17 and 22 gm. total aldrin, and the chemical was recovered from the tissues, mainly the body and perirenal fat, in amounts ranging from less than one to 50 p.p.m. Degenerative changes in the kidney and liver were observed in all four, and dogs that fed on the organs and meat from the ewe and cow died from aldrin poisoning; bioassay showed them to have 8·2–12 p.p.m. aldrin in the liver and brain. The omental fat of three heifers given 0·5, 1 and 2 mg. aldrin per kg. for 64 days and then grazed on a pasture free from aldrin for 100 days contained less than 1 p.p.m. The one that received the highest dosage showed symptoms of poisoning between the 29th and 50th day of treatment, but recovered, and the others were apparently unaffected.

BIRD (F. T.). **The Dissemination and Propagation of a Virus Disease affecting the European Pine Sawfly, *Neodiprion sertifer* (Geoff.).**—*For. Insect Invest.* **6** no. 5 pp. 2–3. Ottawa, 1950.

Larvae of *Neodiprion sertifer* (Geoffr.) that had been killed by a virus disease unknown in Canada were received there in 1949 from Europe, where the disease

was discovered. It was found that the virus was particularly pathogenic to the population of *N. sertifer* in Canada and similar in its effect to the virus disease that controlled the European spruce sawfly [*Gilpinia hercyniae* (Htg.)] there [*cf. R.A.E.*, A **33** 398].

Experiments on the artificial dissemination of the disease were made in 1950 in heavily infested pine plantations in southern Ontario. A stock suspension was prepared from 2,000 larvae killed by the virus in 2,000 cc. water, and sprays were made up by further diluting this. In plot tests in which the foliage was drenched with spray, examination after 15 days showed that the percentages of colonies (groups of ten or more larvae) in which mortality was complete were 47·7, 89·4, 98·8, 100 and 100 for sprays of 0·1, 1, 10, 100 and 250 cc. stock suspension in 3 gals. water, respectively. Although the trees had been sprayed early in the morning or late in the evening when air currents were slight, and mats had been placed between them, it was found that mortality from the disease also occurred in rows of trees 3–15 ft. from those sprayed. It is thought that this was due to drifting at the time of spraying. It was highest on trees adjacent to the plots that received concentrations of 100 and 250 cc., and was complete in 65·1 per cent. of the colonies on these. There was no effect after 15 or 19 days on unsprayed trees about 200 ft. from sprayed ones. Examination of samples of larvae taken from a pine plantation 12 days after an application of the spray at a concentration of 50 cc. per 3 gals. showed that 2,472 of 2,887 individuals were dead. There was no mortality in the control plot 200 yards away.

In a further test, the effectiveness of spraying two plots in a plantation was estimated by an analysis of the cocoon population. The first plot was divided into three sections. The first two of them were sprayed at 50 cc. in 3 gals. spray on 2nd and 4th June, respectively, when many of the larvae were spinning their cocoons. The numbers of cocoons per sq. ft. found subsequently were 8·1 and 12·7, respectively ; 26·1 and 21·4 per cent. of them were parasitised and 34 and 40·4 per cent. dead. The third section was sprayed at 10 cc. on 6th June ; 28·8 cocoons were found per sq. ft., of which 21 per cent. were parasitised and 53·4 per cent. dead. Many dead larvae were found on the foliage and on the ground in all sections. It was difficult to assess the degree to which the virus had killed the larvae in the cocoons, as they had been attacked by entomogenous fungi. The second plot was sprayed at 5 cc. in 3 gals. on 8th June. There were 24·9 cocoons per sq. ft., of which 16·8 per cent. were parasitised and 7·5 per cent. were dead. Mortality was low in this plot because many of the larvae had spun their cocoons before the spray was applied. The control plot had 34·3 cocoons per sq. ft., of which 29·3 per cent. were parasitised and 10·2 per cent. dead.

DAY (M. F.). **Studies on the Digestion of Wool by Insects. I. Microscopy of Digestion of Wool by Clothes Moth Larvae** (*Tineola bisselliella* **Humm.**).—*Aust. J. sci. Res.* (B) **4** no. 1 pp. 42–48, 2 pls., 12 refs. Melbourne, 1951.

POWNING (R. F.), DAY (M. F.) & IRZYKIEWICZ (H.). **II. The Properties of some Insect Proteinases.**—*T.c.* pp. 49–63, 6 figs., 25 refs.

DAY (M. F.). **III. A Comparison between the Tracheation of the Midgut of** *Tineola* **Larvae and that of other Insect Tissues.**—*T.c.* pp. 64–74, 2 pls., 20 refs.

Although much is known of the physiology of the digestion of wool by larvae of *Tineola bisselliella* (Humm.), the actual course of digestion is still under investigation and it was not known whether the larvae can digest raw wool

with all its labile sulphur in the form of disulphide linkages [*cf. R.A.E.*, A **39** 5]. The work described in the first part of this series, the main results of which have already been noticed [**39** 42], showed that the larvae digest both wool fibres and scale cells, and that the latter are, except for the epicuticle, as readily digested as the cortical cells though they are resistant to most enzymes. Raw wool was digested as readily as partly hydrolysed wool, such as is obtained by weathering raw wool and found in fabrics. Visible evidence of the digestion of keratin fibres first appears in a restricted section of the mid-gut, and there is a sharp line of demarcation between undigested and partly digested fibres. The epithelium in this region differs histologically from the preceding one, and an unusually high reducing potential is maintained in the lumen in the same region.

The following is largely the authors' summary of the second part. The effects of various protease activators and inhibitors on crude proteinase preparations from the mid-guts of larvae of *T. bisselliella*, *Tenebrio molitor* L., and *Musca domestica* L. and adults of *Periplaneta americana* (L.) and *Locusta migratoria* (L.) were studied and compared with their effects on trypsin and papain. Similarly, a comparison was made of the pH optima, heat stability and milk-clotting ability of the enzyme preparations and of the effects of oxidation-reduction potential on their hydrolytic ability. In general, the insect enzymes were found to be similar to one another and to resemble trypsin more closely than papain. The differences between them were all of a minor character, and the evidence indicates that the ability of the larvae of *T. bisselliella* to digest keratin does not reside in their protein-digesting enzymes.

The studies on the tracheation of the mid-gut of *T. bisselliella* and other insects described in the third part showed that the tracheal supply is poor in larvae of *T. bisselliella* ; this probably contributes to their ability to digest keratin, though other insects, which do not digest it, also have poor tracheation.

Fry (P. R.). **Lettuce Mosaic.**—*N.Z. J. Sci. Tech.* **33** (A) no. 5 pp. 52–63, 4 figs., 6 refs. Wellington, N.Z., 1952.

An account is given of investigations in New Zealand on a virus disease of lettuce, which, from a comparison of the symptoms, host range, physical properties of the virus, and method of transmission, appeared to be identical with lettuce mosaic [*R.A.E.*, A **27** 671]. The symptoms, which are described, comprise vein clearing, mosaic mottling, necrosis, dwarfing and failure to form hearts. In experiments, the disease was transmitted by leaf abrasion or by means of *Myzus persicae* (Sulz.) to endive, aster (*Callistephus chinensis*), marigold (*Tagetes erecta*), cineraria (*Senecio cruentus*), groundsel (*S. vulgaris*), pea and sweet pea (*Lathyrus odoratus*), though symptoms did not develop on all of them, and groundsel was found naturally infected in the field. The disease was not transmitted to plants of 15 other species in four families. In transmission experiments, nine Aphids were tested as vectors, but only *M. persicae*, *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) and *Aphis gossypii* Glov. transmitted the virus. Aphids became infective after feeding on diseased plants for 2–5 minutes, but lost their infectivity in less than 30 minutes when transferred to healthy plants. Earlier findings that the disease is transmitted through the seed were confirmed.

Infection was widespread in lettuce crops on the two islands, and averaged 25 per cent. in 26 commercial crops, though there was considerable variation that could not be attributed to season, age of crop or variety. In an experiment on the effect of infection on yield, the crop weight of plants that became infected as seedlings was reduced by 51·6 per cent. ; the reduction in yield became progressively smaller as the date of infection became later.

HAMILTON (A.). **Codling Moth Investigations in Nelson, 1948–49.**—*N.Z. J. Sci. Tech.* **33** (A) no. 5 pp. 90–97, 3 figs., 6 refs. Wellington, N.Z., 1952.

Investigations were carried out in 1948–49 in three widely separated apple orchards in the neighbourhood of Nelson, New Zealand, to ascertain the flight period of the codling moth [*Cydia pomonella* (L.)] and the date at which apples first become infested. Baits consisting of a solution of 1 pint molasses in 20 pints water with the addition of 77 ml. of a mixture of 30 ml. aniseed oil, 168 ml. water and 6 gm. bentonite per quart were exposed in large jam tins suspended in the trees; a small amount of yeast was occasionally included to start fermentation, and a teaspoonful of brown sugar was added to each tin once a week. The bait solution remained more uniformly attractive to the moths if only half the contents of a tin were renewed at a time; new fermenting solution was not attractive during the first 2–3 days. The baits were maintained in the orchards from October to March, and the results are compared with those of an earlier investigation [*R.A.E.*, A **21** 92]. Trees in two of the orchards were banded in January and December 1948, and the trapped larvae reared in the insectary, and fruits from one of them were examined for infestation.

Moths were caught from 31st October to 14th March. There was some correlation between daily mean temperature and the size of the catch [*cf. loc. cit.*], and there were two peaks, one on 9th–17th December and another that reached a maximum on 31st January. These were probably due to fluctuations in emergence caused by weather conditions; there was only one among moths reared in the insectary. The flight periods coincided in all three orchards. It was found that the number of moths caught gave no indication of the size of the population as assessed by fruit infestation; one of the orchards, in which relatively few moths were trapped, was subject to low evening temperatures and strong winds, and these conditions may have hindered flight. Males and females were taken in equal numbers during the second peak of the flight.

On 23rd December 1948, infestation of the young apples amounted to only 15·6 per cent.; 66·7 per cent. of the larvae were in the first instar and, of the rest, half were in the second and half in the third instar. By 20th January, about 50 per cent. of the apples were infested and most of the larvae were in the third and fourth instars. Larvae first entered the bands between 5th and 14th January. There was no second generation.

TAYLOR (G. G.). **Spray Treatments for Control of Leaf Roller** (*Tortrix postvittana* **Walker**) **in Apple Orchards.**—*N.Z. J. Sci. Tech.* **33** (A) no. 5 pp. 98–103, 3 refs. Wellington, N.Z., 1952.

Following the substitution of DDT for lead arsenate in sprays against *Cydia pomonella* (L.) on apple in New Zealand, damage by *Tortrix postvittana* (Wlk.) increased in importance, especially in the Nelson district, where infestation has always been heavy, and in orchards in which DDT was used throughout the season, instead of from January onwards, as recommended. The relative effectiveness of these two materials against *T. postvittana* was accordingly investigated in field trials in 1947–48, when lead arsenate was applied at 1·5 lb. per 100 gals. and wettable DDT at 4 oz. p,p′isomer, which is the concentration recommended against *C. pomonella*. Schedules of five or six applications of lead arsenate gave good commercial control of *T. postvittana* and were greatly superior to similar schedules of DDT. Three applications of lead arsenate followed by two or three of DDT from late December were significantly superior to five or six applications of DDT, but significantly inferior to five or six of lead arsenate where infestation was severe.

In view of the injuriousness of lead arsenate to the fruits and foliage [*cf. R.A.E.*, A **39** 325], DDT was compared with other alternative materials in 1948–49. DDT proved relatively ineffective, even at a concentration of 8 oz. per 100 gals., and there was no significant improvement when 2 or 4 oz. DDT was combined with 1·5 lb. lead arsenate. The best results were given by wettable DDD at 8 oz. of the technical product per 100 gals., and in the following year this material was again superior to lead arsenate at a concentration of 8 oz. per 100 gals. and comparable with it at 4 oz. It was most effective when applied at petal-fall, in November, and there were significant increases in damage to the fruits by *T. postvittana* when application was delayed until December or January–February. A wettable powder containing 15 per cent. parathion gave results comparable with those from 4 oz. DDD at concentrations of 4 and 8 oz. per 100 gals. and 8 oz. DDD at concentrations of 1 and 2 lb., and did not injure the trees. Although both parathion and DDD show promise, further investigations are necessary before they can be recommended.

DUMBLETON (L. J.). **Coleophoridae (Lep.) as Pests of Clovers.**—*N.Z. J. Sci. Tech.* **33** (A) no. 5 pp. 109–112, 2 figs., 6 refs. Wellington, N.Z., 1952.

The author gives a list of four species of *Coleophora* recorded by Meyrick as feeding on papilionaceous plants in Europe and states that three of them also occur in the southern hemisphere. These are *C. spissicornis* (Haw.) and *C. frischella* (L.), which occur in New Zealand, the latter being recorded there for the first time, and *C. deauratella* Zell., which Meyrick recorded from Tasmania. It is stated in a foot-note that specimens of *Coleophora* since received from Hobart appear to be identical with *C. frischella*. A key to the adults of the three species is given ; no characters are known for differentiating the larvae or their cases. The adults of *C. spissicornis* and *C. frischella* are described and their distribution in New Zealand given ; both are known from both islands and probably occur throughout the country. *C. spissicornis* attacks the seeds of white clover (*Trifolium repens*) and appears to be of little economic importance [*cf. R.A.E.*, A **33** 184, etc.], probably owing to its early appearance in relation to the flowering and harvesting dates of seed crops of *T. repens* and the fact that it produces only one generation a year. Adults of *C. frischella* are present from late October until March or April ; peak numbers were taken in January, when this species was over ten times as numerous as *C. spissicornis*. Second-generation adults emerged on 18th December ; there is probably a third and possibly a partial fourth generation each year. The food-plants recorded are *T. repens*, *T. pratense* and *T. fragiferum*, but no damage by it to the seeds of *T. pratense* has as yet been observed. Larval populations of about 20 per sq. ft. were found in the spring of 1950 in a field in which seeds of *T. repens* had been damaged during the previous summer. Totals of 83 and 38 adults of *C. frischella* emerged from 110 heads of *T. repens* collected in late December and from 31 collected in early January, respectively. Eggs collected from heads of *T. repens* hatched within seven days. Cased larvae pupated and gave rise to adults not less than 12 days after leaving the heads. The larval stage probably lasts about four weeks, and the spring or early-summer generation about seven weeks. There is no evidence that the overwintering larvae feed in spring prior to pupation. Three of 20 overwintering *Coleophora* larvae collected from the soil at a place in South Island were parasitised by a nematode tentatively determined as *Neoaplectana* sp.

First-instar larvae feed in the young green seeds, and the larger ones sometimes completely destroy the nearly mature seeds, leaving only the husk. Much of the damaged seed is so light that it is probably lost during harvesting, and the true extent of the damage is therefore not known. Since heavily damaged crops

are of sporadic occurrence, pasture management may have an important bearing on the intensity of infestation.

LAMB (K. P.). **Note on the Survival without Food of Australian Carpet Beetle Larvae** (*Anthrenocerus australis* (**Hope**)) (**Coleoptera : Dermestidae**).—*N.Z. J. Sci. Tech.* **34** (B) no. 1 pp. 67–68, 1 fig., 1 ref. Wellington, N.Z., 1952.

The larvae of certain Dermestids survive for long periods without food, especially at low temperatures, and this is generally attributed to an ability to become dormant. Since the period for which they resist starvation at normal temperatures is of importance for control by stomach poisons, preliminary observations were made in New Zealand on *Anthrenocerus australis* (Hope) at 27°C. [80·6°F.] and 75 per cent. relative humidity. Seven larvae 96–112 days old were placed in a glass jar with a wire mesh inset in the lid, and ten similar ones were confined individually in glass vials stoppered with cotton wool ; mortality counts were made every ten days. The isolated larvae survived for 110–220 days, and those in the jar, among which cannibalism took place, for 180–340 days, and moulting and activity were normal. At the lower temperatures and humidities found under household conditions, the larvae could probably become dormant and survive for much longer periods. Contact poisons may therefore be of more value in eradicating infestation than stomach poisons alone, especially if the latter are repellent.

LODOS (N.). **Türkiye'de yeni bir Süne paraziti :** *Alophora* (*Phorantha*) *subcoleoptrata* **L.** [*A. subcoleoptrata*, a Parasite of *Eurygaster integriceps* new for Turkey.]—*Bull. Plant Prot.* no. 2 pp. 23–26, 3 figs., 2 refs. Ankara, 1952. (With a Summary in French.)

Alophora subcoleoptrata (L.), a Tachinid known to parasitise *Eurygaster integriceps* Put. in the Soviet Union [*cf. R.A.E.*, A **33** 301 ; **36** 241 ; **40** 309], was observed in 1950, for the first time in Turkey, parasitising that Pentatomid in the mountainous region of Karacadag. The larvae left their hosts in October and pupated in the soil, and the pupae overwintered, the adults emerging in the laboratory in the following March. The percentage parasitism did not usually exceed 5, but reached 25 in certain cases.

ERKILIÇ (S.) & SÜMER (S.). **Eskişehir'de yeni bir zararlı böcek** (*Sphenoptera carceli* **E. ve G.**). [*S. carceli*, a new Pest in Eskişehir.]—*Bull. Plant Prot.* no. 2 pp. 27–29, 3 figs., 5 refs. Ankara, 1952. (With a Summary in English.)

Larvae of *Sphenoptera carceli* C. & G. were found in the late summer of 1951 damaging the roots of sainfoin (*Onobrychis sativa*) in the district of Eskişehir. This Buprestid had not previously been observed in Turkey.

ERKILIÇ (S.) & TEOMAN (N.). **Diyarbakır'da madrap çekirgesi** (*Locusta migratoria* **ph.** *danica* **L.**) **durumu ve savaş denemeleri.** [The Status and Experiments on the Control of the Rice-field Locust at Diyarbakır.]—*Bull. Plant Prot.* no. 2 pp. 50–57, 1 fig. Ankara, 1952. (With a Summary in English.)

Locusta migratoria (L.) phase *solitaria* (ph. *danica* (L.)) has for several years caused extensive damage to rice in the district of Diyarbakır, in south-eastern Turkey. Observations showed that it has two generations a year. Hoppers of the overwintering generation hatch in rice-fields of the previous year from late

April to late May and are not injurious as rice is not planted in the same field continuously, and the adults fly to new rice-fields in late May and June. Hoppers of the next generation appear in late July, and they and the adults to which they give rise feed on the rice until harvest. Oviposition continues even after the rice is cut, and the eggs overwinter.

In experiments in 1951 on the control of the hoppers that hatched in rice-fields of the previous year, various proprietary insecticides were applied to plots on 21st May. Counts made two days later showed that complete mortality was given by several sprays containing BHC at suitable concentrations and one containing parathion, 95 per cent. mortality by a parathion dust, and 80 per cent. by a toxaphene dust ; chlordane in sprays or dust and a DDT dust were less effective.

ALEXANDROV (N.). *Eurygaster integriceps* **Put. à Varamine et ses parasites.**—[*In Persian.*]—*Ent. Phytop. appl.* no. 5 pp. *29–41*, 11 figs. Teheran, 1947. *Op. cit.* no. 6–7 pp. *28–47*, 6 figs. 1948. *Op. cit.* no. 8 pp. *16–52*, 14 figs., 12 refs. 1949. (With a Summary in French, no. 5 pp. 11–14, no. 6–7 pp. 8–17, no. 8 pp. 13–20.)

Eurygaster integriceps Put. causes serious damage to cereals, particularly wheat, in the district of Teheran. The adults feed at first on the leaves or at the base of the shoots, and both they and the nymphs suck the grains in the stage of milky ripeness. Observations on the bionomics of the Pentatomid and its parasites were made in the plain of Varamin, to the south of the Elburz mountains. These showed that the adults fly from their hibernation quarters to the fields in spring, when the temperature reaches 21–22°C. [69·8–71·6°F.], and can cover distances of 16–19 miles in a single flight. Pairing begins towards 25th March and becomes general by about mid-April, and oviposition takes place from the beginning of April until mid-May. The females deposit 70–80 eggs each in batches of 5–30 on the leaves, stalks or ears of wheat or on other plants, and a single female has been reported to deposit as many as 306. Hatching begins in mid-April and reaches a maximum at about the end of the month, and the adults of the new generation appear during June. After a few days, they fly to the mountains in large bands, and there they rest on slopes with a northern aspect until the first rains occur in October, when they shelter under wild vegetation on southern slopes [*cf. R.A.E.*, A **40** 309].

The parasites found comprised the Encyrtid, *Schedius telenomicida* (Vasil'ev), and the Scelionids, *Trissolcus simoni* (Mayr), *Dissolcus rufiventris* (Mayr), *Telenomus sokolowi* Mayr, *T.* (*Phanurus*) *politus* (Thoms.), *Microphanurus semistriatus* (Nees), *M. vassilievi* (Mayr) and *Hadronotus pedester* (Kieff.), which attack the eggs, and the Tachinids, *Phasia crassipennis* (F.), *P. rostrata* Egger, *Helomyia lateralis* (Mg.), *Clytiomyia helluo* (F.) and *Cistogaster globosa* (F.), which attack the adults. Of these, *M. semistriatus*, *M. vassilievi*, *P. crassipennis* and the species of *Helomyia* and *Clytiomyia* were studied in detail in 1947–48 in the field and in the laboratory, and information is given on the appearance and bionomics of the first three, which are the most important, and brief notes on the last two, which occur in small numbers and are of little value in control. *M. semistriatus* overwinters, apparently only as the fertilised or unfertilised female, under the bark of various trees from late December, whereas adults of *M. vassilievi* overwinter in other sheltered places, not necessarily near plantations. The bionomics of the two species are similar. The adults appear in the fields shortly before oviposition by *Eurygaster* begins. Winter mortality is high, and parasitism is therefore low at the beginning of spring, but the parasites reproduce rapidly and pass through several generations during the oviposition period of *Eurygaster*, so that late eggs are heavily attacked. The adults pair after feeding on nectar for some days, and the males

then die. Females of *M. semistriatus* laid 84–122 eggs each in the laboratory over a period of 30 days. Fertilised and unfertilised females deposited about the same number, but the former gave rise mainly to females and the latter only to males. Normally, only one egg was laid in each host egg, and if there were more, no parasite matured. Recently laid host eggs are preferred, and parasites rarely matured in older ones. Development is completed within the host egg, and lasts 9–27 days according to temperature. In Varamin, it averaged 12–14 days, so that there might be 14–15 generations in the year. The first three or four can develop in *Eurygaster*, but later ones would require the presence of other Hemiptera in which to breed, and these are largely lacking as the weeds that are their food-plants are killed when the irrigated fields are allowed to dry after harvest. Also, there are few other plants beneath which the parasites can shelter from the great summer heat, which kills many of them. However, a few find other hosts or survive through the summer without ovipositing. *P. crassipennis* has only one generation a year and oviposits on adults that have their wings extended for flight. The larvae develop internally and usually overwinter in their hosts, pupating in spring on the surface of the soil, though a few may pupate in autumn and overwinter in the pupal stage.

Methods recommended for the control of *Eurygaster* in grainfields comprise collecting the insects from the plants by means of a portable apparatus that is described, dusting with calcium arsenate and, after harvest, lifting the stooks and spraying under them with 1 per cent. sodium arsenite. During the autumn and winter, the bugs can be controlled by applying Cyanogas calcium cyanide under the plants beneath which they shelter, and this gave 85–90 per cent. mortality in August 1945. Collecting the bugs from their shelters in early autumn and burning the wild plants are laborious and not very effective, and are not recommended unless other methods are impracticable. The rearing and liberation of *Microphanurus* have given promising results, and methods of collecting and rearing the host and parasites are described. The adult parasites or parasitised eggs should be distributed in two batches, 2–3 and 6–8 days after the appearance of *Eurygaster* in spring, and some 25,000 per acre will be required if the bugs are present at the rate of 2·5–4 per sq. yard. Adult parasites can also be released under frames set up in the field in early spring and stocked with *Eurygaster* adults collected from their hibernation sites, and these will produce one or two generations before the general spring migration, following which parasites are liberated in the field. The adult parasites in the frame should be fed with sugar solution twice a day.

KAUSSARI (M.). **Les cochenilles nuisibles aux arbres fruitiers en Iran.** [*In Persian.*]—*Ent. Phytop. appl.* no. 5 pp. *44–51*, 1 fig. Teheran, 1947. *Op. cit.* no. 6–7 pp. *22–27*. 1948. *Op. cit.* no. 9 pp. *1–22*, 8 figs., 3 refs. 1949. (With a Summary in French, no. 5 pp. 16–17, no. 6–7 pp. 6–7, no. 9 pp. 1–4.)

A list is given of 23 species of Coccids that are injurious to fruit trees in Persia, with notes on their appearance, the trees attacked and the localities in which they have been found [*cf. R.A.E.*, A **36** 387].

TCHOUVAKHINE (V.). *Pentodon idiota* **Herbst nuisible à la canne à sucre.** [*In Persian.*]—*Ent. Phytop. appl.* no. 9 pp. *47–52*, 2 figs., 5 refs. Teheran, 1949. (With a Summary in French, pp. 11–12.)

Damage to sugar-cane in the region of Ahraz, Persia, in 1949 was found to be caused by *Pentodon idiota* (Hbst.). Infestation by this Dynastid during

spring and summer resulted in 90 per cent. loss of crop in some localities. The adults leave the soil in spring and are active until the end of the summer, flying by night. The larvae live for two years in the soil, feeding on plants, and pupate during the summer of the third year. The adults emerge after two weeks, but remain in the soil until the following spring. The injury is caused by the larvae, which make galleries in the collar of the plant, and by the adults, which bore into the heart of the cane to feed. Control measures include the collection of larvae and adults and distributing BHC dust evenly over the soil and working it in.

VAN DER GOOT (P.). **De walang sangit** (*Leptocorisa acuta* **Thunb.**) **als vijand van het rijstgewas in Indonesië.** [The Rice Bug (*L. acuta*) as a Pest of Rice in Indonesia.]—*Meded. alg. Proefst. Landb.* no. 88, [1+] 66 pp., 4 figs., 36 refs. Buitenzorg, 1949. (With a Summary in English.) Also in *Landbouw* **21** pp. 293–358. Buitenzorg, 1949.

An account is given of investigations in 1921–32 on the bionomics and control of the Coreid, *Leptocorisaacuta* (Thnb.), on rice in Indonesia, and the results are compared with those recorded by Corbett in Malaya [*R.A.E.*, A **19** 296]. Of the eight species of *Leptocorisa* that occur in Indonesia, *L. acuta* is the only one of economic importance, and it is present throughout the territory. The area infested in Java ranged up to about 25,000 acres in some years, and crop losses averaged 25–50 per cent. All stages of the bug are described. The eggs were laid in batches of 12–16 in one or two rows on both surfaces of the upper leaves of flowering rice and wild grasses, but not on rice after the grains had reached the milk-ripe stage. The young nymphs were active and fed throughout the day on the green or milk-ripe grains, but older nymphs and adults sheltered from the sun and were active only in the early morning and evening. Development from egg to adult lasted at least 19 days, so that only one generation was completed on each rice crop. In the laboratory at Buitenzorg (altitude about 800 ft.), the egg and nymphal stages averaged 6 and 21–22 days, respectively. Pairing and oviposition occurred 3–37 and 16–112 days, respectively, after the last moult, and the maximum number of eggs laid per female was 359. The adults survived for 4–6 months on rice and for up to eight months on certain wild grasses. At Lembang (altitude nearly 4,000 ft.), the egg and nymphal stages averaged 16 and 38 days, respectively. Adults that had been reared on wild grasses showed a different coloration from those reared on rice.

Males and females were present in equal numbers and fed in the same way as the nymphs. They migrated to fresh rice-fields as these began to flower and were very injurious in early-flowering fields when these were few in number. They then dispersed to later-flowering fields, and injury was then comparatively slight, but if the flowering season was extended for three months or more, the population was so increased that the last fields to flower were again heavily infested. During the dry season, the bugs migrated to wild grasses or fed on irrigated rice. They often collected in masses in shady or humid places, remaining there for several days or weeks, but few eggs were laid and the dry-season crop suffered little damage.

Non-bearded varieties of rice were less injured than bearded ones, which was contrary to the findings of Uichanco [**10** 75] and Corbett [**11** 533], and the bugs were reared without difficulty in the laboratory on plants grown from imported seeds of bearded varieties claimed to be wholly or partly resistant. The principal natural enemies observed were two egg-parasites, *Ooencyrtus malayensis* Ferrière and a species of *Hadronotus*. Examples of the latter from Java were identified by Gahan in 1929 as *H. flavipes* Ashm., which was described in 1905 from the Philippines, but later material, also from Java, was considered

by Nixon in 1934 to represent a new species, which he described as *H. leptocorisae* [**22** 128]. The author states that *H. leptocorisae* is thus probably a synonym of *H. flavipes*, but van der Vecht in a footnote considers it unlikely that the two species are identical. In normal years, *Ooencyrtus* parasitised 1–7 per cent. of the eggs of *L. acuta*, and *Hadronotus* 6–16 per cent. The adults of both parasites are described, and notes are given on their bionomics. Complete development averaged 14 days for both of them. Traditional and introduced methods of controlling *L. acuta* are discussed in detail. The most important are cultural measures ensuring that the total flowering season is restricted to about ten weeks and that a large number of the fields in a district flower simultaneously. Others include setting bundles of certain indigenous aromatic plants in the fields and killing the adults, mostly males, that are attracted to them, waving flares to and fro in the evening for the same purpose, and collection of the adults with nets. Other methods of control [*cf.* **10** 75; **19** 297] are considered impracticable.

FRANSSEN (C. J. H.). **Levenswijze en bestrijding van de mangga-boktor (*Rhytidodera simulans* White).** [The Biology and Control of *R. simulans* on Mango.]—*Meded. alg. Proefst. Landb.* no. 95, 40 pp., 2 pls., 2 figs., 15 refs. Buitenzorg, 1949. (With a Summary in English.)

Attention was drawn in 1937 to severe injury caused by *Rhytidodera simulans* White to mango (*Mangifera indica*) in the district of Cheribon, Java, and investigations on its bionomics and control were carried out in 1937–39. This Cerambycid also occurs in other parts of Java and in Sumatra and Celebes. It has several other food-plants, including *Canarium*, a tree that is grown mainly for ornamental purposes and has little economic significance.

On mango, eggs were laid singly on or near the tips of the twigs and hatched in 9–12 days [*cf. R.A.E.*, A **27** 227]. The larvae entered the twigs and bored through the branches towards the trunk, usually girdling the twigs or branches just beneath the bark, so that they ultimately broke off. They pupated in the mines after about 160 days, and the adults emerged about 60 days later. On *Canarium*, the branches were not girdled, and the larval stage lasted about 180 days. The adults did not feed and survived for an average of 54 days in the laboratory. Oviposition began within one or two days of emergence, and females laid an average of 160 eggs each in about 30 days. The sexes were about equal in numbers. Development was continuous, and all stages were present throughout the year.

Experiments on artificial infestation in which eggs were placed on healthy trees all failed, since the larvae were drowned in the sap, but the larvae established themselves on trees attacked by *Gloeosporium* sp. or by the Noctuid shoot-borer, *Chlumetia transversa* Wlk. The conclusion that *R. simulans* was only a secondary pest was confirmed by field observations, in which larvae were found in mines formed by the larvae of *Cryptorrhynchus goniocnemis* Mshl. Caged females laid few or no eggs on wet days, and 39 per cent. of the eggs laid on the trees during a period of heavy rain were washed off. Further, many eggs were so deposited that the larvae were unable to enter directly into the twigs and died. Three parasites were reared from eggs of *R. simulans* laid on *Canarium*. They were the Pteromalid, *Promuscidea unifasciativentris* Gir., an Encyrtid of the genus *Anagyrus* closely related to *A. dactylopii* (How.), and *Eupelmus* sp. None was very numerous.

The geographical distribution and economic importance of *R. simulans* are discussed. Its distribution was not uniform, and infestation was apparently favoured by moist conditions, although no direct relation with climate was established. Infestation was generally rare and slight on mango trees under six

years old. It was normally heavier on mango than on *M. odorata* or *M. foetida*, and was not found on *M. caesia*.

Control by means of insecticides is not practicable, and cutting away infested branches or even the whole crown was soon followed by reinfestation, even when the trees were well isolated from other mango plantations. Control of the primary pests that precede *R. simulans*, cultural measures to promote vigorous growth of the trees, and regular inspection and removal of infested branches are recommended.

CHU (H. F.) & TENG (K. F.). **Life-history of the Leafhopper, *Cicadella viridis* (L.) (Homoptera : Cicadellidae).** [*In Chinese.*]—*Ann. ent. Sinici* **1** no. 1 pp. 14–40, 24 figs., 2 graphs, 7 refs. Peking, 1950. (With a Summary in English.)

Studies were made in Peking in 1947–49 on the life-history and habits of *Tettigella* (*Cicadella*) *viridis* (L.) [*cf. R.A.E.*, A **27** 398 ; **35** 224], all stages of which are briefly described. This Jassid attacks many crops and fruit trees and severe damage by it to wheat, sorghum and maize has been reported in recent years from Kiangsu, Shantung, Hopei and the north-eastern provinces of China. It has three generations a year. The overwintered eggs hatch in April, and the adults emerge in May and are present until July. The first generation occurs from June to August, and the second from July to November. A list is given of 166 plants in 39 families on which the pest has been observed. The work included investigations on the choice of particular plants and plant parts for oviposition, and it is stated that parasites of three species were reared from the eggs.

MAŘAN (J.). *Beauveria Brumpti* **Langeron (1934) comme parasite des insectes.** [*In Czech.*]—*Acta Soc. zool. Čsl.* **12** pp. 89–96, 6 refs. Prague, 1948. (With a Summary in French.)

Laboratory experiments were carried out in Czechoslovakia in 1944–45 to test the value of the fungus, *Beauveria brumpti*, for the control of insects. The fungus was cultured on various media, and high mortality was given by applying a dust of the spores to larvae of *Tenebrio molitor* L., adults of *Calandra granaria* (L.), and larvae and adults of *Ephestia kuehniella* Zell., death occurring 9–14, 8–18, 12–14 and 2–4 days later, respectively. The virulence of the spores was greatly increased when ground examples of the insects tested were added to the medium on which the fungus was cultured. The experiments were mostly carried out at a temperature of 18–21°C. [64·4–69·8°F.], and negative results were obtained below 14°C. [57·2°F.]. Various insects and a mite that are resistant to other species of *Beauveria* were immune to infection.

PAPERS NOTICED BY TITLE ONLY.

Narcissus Pests [in Britain].—*Bull. Minist. Agric. Fish.* no. 51, 4th [revd] edn., iv+36 pp., 5 pls. (1 col.), 1 map, 42 refs. London, 1952. Price 2*s.* 6*d.* [*Cf. R.A.E.*, A **36** 32, etc.]

GREAVES (T.) & VENABLES (D. G.). **The insecticidal Control of Cabbage Pests at Canberra, A.C.T. Results of comparative Field Tests, 1944–48.**—*Bull. sci. industr. Res. Org. Aust.* no. 258, 51 pp., 5 pls., 3 figs., 10 refs. Melbourne, 1950. [For shorter account see *R.A.E.*, A **38** 167.]